CENTAUR

Bally

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Installation and General Game Operation Instructions

INDEX

BLOCK DIAGRAM—ELECTRONIC PINBALL GAME

A14: SQUAWK AND TALK MODULE

SWITCH MATRIX (INPUTS)

*A9: AUX. LAMP DRIVER MODULE

A1: DISPLAY DRIVER MODULE

A3: SOLENOID DRIVER MODULE

A4: MPU MODULE

A5: LAMP DRIVER MODULE

A2: POWER TRANSFORMER MODULE

I. INSTALLATION

Assemble the game as follows:

Bolt legs to cabinet. Bolt back box to cabinet. Use flat washers under bolt heads. Gently feed cable connectors and ground braid through cable port in back box. Screw ground braid to braid in back box. Carefully and fully insert connectors on printed circuit assemblies.

On all games there are certain items that should be checked after shipment. These are visual inspections which may avoid time consuming service work later. Minor troubles caused by abusive handling in shipment are unavoidable. Cable connectors may be loosened, switches (especially tilt switches) may go out of adjustment. Plumb bob tilt switch should always be adjusted after game is set on location and leg levelers are adjusted.

Visual inspections before plugging in line cord:

1. Check that all cable connectors are completely seated on printed circuit assemblies.
2. Check that cables are clear of all moving parts.
3. Check for any wires that may have become disconnected.
4. Check switches for loose solder or other foreign material that may have come loose in shipment and could cause shorting of contacts.
5. Check wires on coils for proper soldering. Cold solder connections may not show up in factory inspection, but vibration in shipment may break contact.
6. Check that fuses are firmly seated and making good contact.
7. Check the transformer for any foreign material shorting across wiring lugs.
8. Check wiring of transformer to correspond to location voltage. See figure 1.

Check adjustment of the three (normally open) tilt switches:

1. Panel tilt on bottom of playfield panel.
2. Plumb bob tilt on left side of cabinet near front door.
3. Ball tilt above plumb bob tilt. Insert the smaller ball (15/16″ dia.) into the ball tilt assembly, and adjust the bracket so the ball will roll free to contact the switch blade, if front of cabinet is raised.

TRANSFORMER CONNECTION INSTRUCTIONS

REFER TO POWER SUPPLY SCHEMATIC IN GAME MANUAL FOR TABLE "A"

115 VAC,	2-8, 3-6, 7-10
120 VAC,	2-8, 4-6, 7-11
220 VAC,	4-8, 7-9
240 VAC,	4-8, 7-11

PART OF POWER—TRANSFORMER MODULE A2, LOCATED IN LOWER CABINET

II. GENERAL GAME OPERATION

Place ball into playfield by outhole.

Coin game. Coin should be rejected. Plug in line cord. Move power ON-OFF master switch at bottom right front corner of cabinet to 'ON' position. The game will play a power-up tune to announce game-readiness. Drop targets are reset, scores are set to zero, alternating with the 'High Score to Date,' and the game is ready for play. Coin game. The game should accept the coin and post credits* for coins accepted (adjustable). Pressing the credit button on the door will cause the outhole kicker to serve the ball to the shooter alley. The 1st player-up lite is lit. A game-up tune* is played to announce play-readiness.

One player is posted each additional time the credit button is pressed (one to four can play). The credits are reduced by one each time the credit button is pressed until the credits are reduced to zero.

Shooting the ball initiates play.

The game awards all points earned by the player. If spinner is turning and scoring when the ball hits a target, the spinner and the target scores are awarded.

When the ball enters the outhole, the bonus score is added to the total score. The player-up and/or ball in play on the back box is advanced one position. The outhole kicker serves the ball to the shooter alley and play is resumed. This continues until each player has played the allowable number of balls per game (adjustable). At this time the 'Game Over' light is lit. A random Match* number appears and the 'Match' light is lit. If the number is the same as the last two digits in a player's score, a free game is awarded.

Extra balls won during the course of the game are played immediately after the player's regular ball enters the outhole. The player-up and/or ball in play on the back box are not advanced for extra ball play. Bonus score is added to the player's score before the game serves the extra ball for play.

Scoring over 10,000,000 gives "High Score to Date" award.

At the end of the game, a 'High Score to Date' is alternately flashed with all 4 player scores. If the 'High Score to Date' is beat, this feature* awards free games.

Tilting the game results in loss of a ball. The flippers, thumper-bumpers, etc., go 'dead.' Bonus points are not scored. The purpose of the tilt penalty is to discourage the player from jostling the machine in an attempt to prolong play. Game action becomes normal after the ball kicker assembly serves the ball to the shooter alley.

Slamming the machine results in loss of the game. All feature lights go out, the game goes 'dead,' and a time delay occurs. The purpose of the time delay is to discourage unnecessary abuse of the machine. After the delay, the 'Game Over' light lites and the power-up tune is played. The time delay occurs anytime one of the slam switches is made to contact. There are two factory installed slam switches, on the front door, and one on left side of cabinet. (Any number of slam switches could be installed by the operator, to meet his individual requirement.) The switch should be adjusted to have approximately 1/16" gap between the contacts. The weighted blade should be adjusted to attain the desired sensitivity. Decreasing the gap between contacts will make the switch more sensitive. Opening the gap will reduce sensitivity.

*Some tunes and features can be disabled by operator if so desired. See Back Box Adjustments.
NOTE: Scoring and feature units will differ from game to game.

III. BOOKKEEPING FUNCTIONS

The game is designed to help the operator perform certain accounting functions. The game can display the number of total plays and replays (free games). It can display the number of coins dropped down each coin chute. The bookkeeping functions are displayed on all player score displays simultaneously. An identification number, 05 to 15, appears on the Match/Ball in Play window as follows:

```
 05—        00 to—     40 = Current Credits
*06—100000 to—99999 = Total Plays (Payed & Free Games)
*07—  10000 to—99999 = Total Replays (Free Games)
 08—        00 to—99999 = Game Percentage
 09—        00 to—99999 = Total times 'High Score to Date' is beat
*10—  10000 to—99999 = Coins Dropped thru Coin Chute #1
*11—  10000 to—99999 = Coins Dropped thru Coin Chute #2**
*12—  10000 to—99999 = Coins Dropped thru Coin Chute #3**
*13—        00 to—99999 = Number of Specials awarded from Panel Specials Only
*14—        00 to—99999 = Number of minutes of Game Play
*15—        00 to—99999 = Number of Service Credits
```

The game displays the first bookkeeping entry if the Self-Test button (See Fig. III) on the inside of the front door is pressed ten times. Alternately push and release the Self-Test button at one second intervals. The number 05 appears in the 'Match/Ball in Play' window. Current credits appear on the player score displays. Each additional press of the button causes the next entry to be displayed.

After the data in each bookkeeping register is recorded, it can be set to zero simply by pressing switch button S33, located on A4, the MPU module in the back box (See Fig. III), or by pressing the Coin Chute #3 switch. Any or all registers can be cleared by alternating between the Self-Test button and the switch button S33 on the MPU module or Coin Chute #3 switch. The operator is given this option as a possible convenience and can elect to use or not use it as his needs direct.

Pressing the button 5 more times causes the game to play the power-up tune and light the Game Over light.

Service credits are designed to allow the serviceman to test the game under actual play conditions without disturbing the bookkeeping records that reside at identification numbers 06, 07, 10, 11 and 12.

To obtain Service Credits, push and release the Self-Test switch until identification number 05 appears in the 'Match/Ball in Play' window. Hold in the Credit button until the desired number of Service Credits (up to five) appears on the player score displays.

NOTE: If, upon accessing identification number 05, a number of credits greater than five is displayed, pressing the credit button has no effect.

Identification number 15 is reserved as a record of the number of Service Credits used.

*The 10,000 level is pre-set at the factory; can be set to zero, initially, if desired.

**If Coin Chute is not used in game, number displayed (if other than 00) on Player Score displays has no significance.

NOTE: If "Total Play" register is reset to zeroes then "Total Replays" register should also be reset to zeroes to maintain the game percentage value.

IV. FEATURE OPERATION & SCORING

A. BONUS SCORE FEATURE

A bonus score of 1000 to 79,000 points may be scored. The game starts with a score of 1000 points. The bonus score advances one step at a time each time the ball hits anyone of unlit 1-4 droptargets, any of the Orbs droptargets or any of the standup targets. The rollover buttons also advance the bonus one step. The loop ball will advance the bonus from 1 to 5 steps or 2 to 10 when doubled. The 1-4 droptargets will advance from 1 to 8 advances depending on the lit value.

B. BONUS OUTHOLE COLLECT AND BONUS MULTIPLIER

When the ball goes into the outhole, the lit bonus score is added to the player's total score. If the 2X light is lit, the bonus score is added to the player's score twice. If the 3X light is lit the bonus score is added three times, 4X, four times and 5X, five times. A tilt nullifies the bonus score.

The bonus multipliers are lit as follows:
The 1st sequence lights the 2X.
The 2nd sequence lights the 3X.
The 3rd sequence lights the 4X.
The 4th sequence lights the 5X.

C. MEMORY BONUS FEATURE

The memory of the bonus is dependent upon two fixed switch settings.

Switch #6 Multiplier Control
    ON: Multiplier in Memory
    OFF: Multipliers Reset

Switch #7 Bonus Control
    ON: All achieved bonus is held in memory.
    OFF: Only 20, 40 and 60 are held in memory.

D. POWER ORB FEATURE (MULTI-BALL)

This game has a unique method for retaining captured balls. Balls are not physically held in storage on the playfield, but instead they are represented by lights. There may be from 1 to 4 captured balls at any one time.

The balls are held below the playfield and are released onto the playfield thru a ramp and kicker arrangement. There are two (2) release targets, they will release all the captive balls when struck. Making the four (4) guardian rollovers or making the O-R-B-S targets in order will release one (1) ball.

The Orb feature controls consists of the following:

Switch #15 Memory on Captive Orbs.
    ON: Lit orbs remain lit until their release.
    OFF: Lit orbs are reset at the end of a ball.

Switch #22 Captive Orb Initialization

    ON: Each ball begins with at least one orb lit.
    OFF: The player must earn all lit orbs.

Switch #24 Memory on Release.
    ON: The lit release target remains lit.
    OFF: Target must be qualified on each ball.

Switch #21 Release on Last Ball
    ON: Liberal
    OFF: Conservative

E. ORBS DROPTARGETS

Knocking down all the Orbs droptargets will add one (1) ball to the captive balls. There can be a maximum of four (4) captive balls at any one time. Knocking down the Orbs droptargets will release another ball into play.

F. GUARDIAN FEATURE

Completing the four (4) guardian rollovers will release one (1) ball into play when lit.

The guardian feature is regulated by:

Switch #16

ON: Guardians release during the entire ball.
OFF: Guardians can only release one ball.

G. SEQUENCE FEATURE

This feature consists of the droptarget bank of four (4) targets. These targets score 500 points and advance bonus when not lit. If these targets are hit in order they will score as follows:

The 1st target scores 10,000 and 1 advance.
The 2nd target scores 20,000 and 2 advances.
The 3rd target scores 40,000 and 4 advances.
The 4th target scores 80,000 and 8 advances.

And it also lights the right release target. Knocking down these targets in or out of order will light the right lane target for collect bonus.

Switch #8
ON: Liberal
OFF: Conservative

H. CHAMBER FEATURE

This feature consists of a ball which when struck by another ball will proceed to knock down the inline drop targets. These targets will score from 10,000 to 50,000 when lit. The value of this feature starts at 10,000 at the beginning of a new game. Hitting a target will award the lit score and increase the targets value.

If this ball is hit by way of the left side rollover button it will score twice the lit value.

I. TILT FEATURE

This game contains two (2) different tilt settings. The type of setting is selected by fixed switch #23.

ON: Ball tilt
OFF: Game tilt

The ball tilt consists of the feature where as a tilt disqualifies that ball from further play.

The game tilt consists of a player being allowed two tilts per game, and then the player is disqualified from further play during that game.

J. SPECIAL REPLAY/X-BALL/NOVELTY MODES

Self test positions 16 and 17 give the operator flexibility to award a replay ball or score (Novelty) when a special is scored. A combination of X-Ball, Novelty can be obtained through the following chart.

Self test position 16 playfield X-Balls and Specials	Set to "03" Award	Set to "02" Award	Set to "01" Award
Inline Target Special	Replay	X-Ball*	50,000
O-R-B-S Target Special	Replay	X-Ball*	50,000
Self-Test Position 17	Set to "03" Award	Set to "02" Award	Set to "01" Award
Scoring Thresholds	Replay	X-BALL**	No Award

(*) 50,000 if same player shoot again is lit.
(**) 25,000 if same player shoot again is lit.

V. GAME ADJUSTMENTS

A. Playfield Panel Post Adjustments:

Posts that control left and right outlane opening on panel can be removed to make access to outlanes easier or harder for ball to enter. See Figure II.

Easier entry will decrease playing time and scoring (conservative).
Harder entry will increase playing time and scoring (liberal).

B. Back Box Game Adjustments:

Each game has thirty-two switches located on A4, the MPU module, located in the back box, that allow play to be customized to the location. See Figure III. Credits per coin, maximum credits, credit display, balls per game, match feature, high game feature, special award and melody are selectable by means of the switches. The switches are contained in four-sixteen lead packages numbered S1-8, S9-16, S17-24, and S25-32 for easy identification. The "ON" toggle position is marked on the assembly. **Turn off power before making adjustments.**

Credits/Coin Adjustments:

The credits per coin are selectable by means of S17-S20 for coin chute #2 (Center). The switch settings and resultant credits/coin are as follows:

S20	S19	S18	S17	Credits/Coin	S20	S19	S18	S17	Credits/Coin
OFF	OFF	OFF	OFF	Same as Coin Chute #1 Settings	ON	OFF	OFF	OFF	8/1 Coin
OFF	OFF	OFF	ON	1/1 Coin	ON	OFF	OFF	ON	9/1 Coin
OFF	OFF	ON	OFF	2/1 Coin	ON	OFF	ON	OFF	10/1 Coin
OFF	OFF	ON	ON	3/1 Coin	ON	OFF	ON	ON	11/1 Coin
OFF	ON	OFF	OFF	4/1 Coin	ON	ON	OFF	OFF	12/1 Coin
OFF	ON	OFF	ON	5/1 Coin	ON	ON	OFF	ON	13/1 Coin
OFF	ON	ON	OFF	6/1 Coin	ON	ON	ON	OFF	14/1 Coin
OFF	ON	ON	ON	7/1 Coin	ON	ON	ON	ON	15/1 Coin

The credits given are selectable by means of switches 1-5 incl., for coin chute #1 and switches 9-13 incl., for coin chute #3. Thirty-one different credit ratios are available for each coin chute. The switch settings and resultant credits/coin are listed below.

CREDITS/COIN ADJUSTMENTS

COIN CHUTE #1 (HINGE SIDE) OR #3 (RIGHT SIDE)		SWITCHES			CREDITS	CREDITS	CREDITS	CREDITS	CREDITS	TOTAL CREDITS/COINS
5 / 13	4 / 12	3 / 11	2 / 10	1 / 9						
OFF	OFF	OFF	OFF	OFF	1/1 Coin					
OFF	OFF	OFF	OFF	ON	2/1 Coin					
OFF	OFF	OFF	ON	OFF	3/1 Coin					
OFF	OFF	OFF	ON	ON	4/1 Coin					
OFF	OFF	ON	OFF	OFF	5/1 Coin					
OFF	OFF	ON	OFF	ON	6/1 Coin					
OFF	OFF	ON	ON	OFF	7/1 Coin					
OFF	OFF	ON	ON	ON	8/1 Coin					
OFF	ON	OFF	OFF	OFF	9/1 Coin					
OFF	ON	OFF	OFF	ON	12/1 Coin					
OFF	ON	OFF	ON	OFF	14/1 Coin					
OFF	ON	OFF	ON	ON	1/2 Coins*					
OFF	ON	ON	OFF	OFF	2/2 Coins*					
OFF	ON	ON	OFF	ON	3/2 Coins*					
OFF	ON	ON	ON	OFF	4/2 Coins*					
OFF	ON	ON	ON	ON	5/2 Coins*					
ON	OFF	OFF	OFF	OFF	6/2 Coins*					
ON	OFF	OFF	OFF	ON	7/2 Coins*					
ON	OFF	OFF	ON	OFF	8/2 Coins*					
ON	OFF	OFF	ON	ON	9/2 Coins*					
ON	OFF	ON	OFF	OFF	12/2 Coins*					
ON	OFF	ON	OFF	ON	14/2 Coins*					
ON	OFF	ON	ON	OFF	1/1st Coin	2/2nd Coin				3/2
ON	OFF	ON	ON	ON	0/1st Coin*	2/2nd Coin	1/3rd Coin	1/4th Coin		3/4
ON	ON	OFF	OFF	OFF	0/1st Coin*	2/2nd Coin	0/3rd Coin**	2/4th Coin		3/4
ON	ON	OFF	OFF	ON	1/1st Coin	1/2nd Coin	1/3rd Coin	2/4th Coin		5/4
ON	ON	OFF	ON	OFF	1/1st Coin	2/2nd Coin	1/3rd Coin	3/4th Coin		7/4
ON	ON	OFF	ON	ON	1/1st Coin	2/2nd Coin	2/3rd Coin	2/4th Coin		7/4
ON	ON	ON	OFF	OFF	0/1st Coin***	0/2nd Coin***	1/3rd Coin			1/3
ON	ON	ON	OFF	ON	0/1st Coin**		0/3rd Coin**	1/4th Coin		1/4
ON	ON	ON	ON	OFF	0/1st Coin****	0/2nd Coin****	0/3rd Coin****	0/4th Coin****	1/5th Coin	1/5
ON	ON	ON	ON	ON	0/1st Coin***	0/2nd Coin***	1/3rd Coin	0/4th Coin****	1/5th Coin	2/5

*No Credits until 2nd coin is dropped.
**No Credits until 4th coin is dropped.
***No Credits until 3rd coin is dropped.
****No Credits until 5th coin is dropped.

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F. GUARDIAN FEATURE

Completing the four (4) guardian rollovers will release one (1) ball into play when lit.

The guardian feature is regulated by:
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This feature consists of a ball which when struck by another ball will proceed to knock down the inline drop targets. These targets will score from 10,000 to 50,000 when lit. The value of this feature starts at 10,000 at the beginning of a new game. Hitting a target will award the lit score and increase the targets value.

If this ball is hit by way of the left side rollover button it will score twice the lit value.

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Self-Test Position 17	Set to "03" Award	Set to "02" Award	Set to "01" Award
Scoring Thresholds	Replay	X-BALL**	No Award

(*) 50,000 if same player shoot again is lit.
(**) 25,000 if same player shoot again is lit.

4A

V. GAME ADJUSTMENTS

A. Playfield Panel Post Adjustments:

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S20	S19	S18	S17	Credits/Coin	S20	S19	S18	S17	Credits/Coin
OFF	OFF	OFF	OFF	Same as Coin Chute #1 Settings	ON	OFF	OFF	OFF	8/1 Coin
OFF	OFF	OFF	ON	1/1 Coin	ON	OFF	OFF	ON	9/1 Coin
OFF	OFF	ON	OFF	2/1 Coin	ON	OFF	ON	OFF	10/1 Coin
OFF	OFF	ON	ON	3/1 Coin	ON	OFF	ON	ON	11/1 Coin
OFF	ON	OFF	OFF	4/1 Coin	ON	ON	OFF	OFF	12/1 Coin
OFF	ON	OFF	ON	5/1 Coin	ON	ON	OFF	ON	13/1 Coin
OFF	ON	ON	OFF	6/1 Coin	ON	ON	ON	OFF	14/1 Coin
OFF	ON	ON	ON	7/1 Coin	ON	ON	ON	ON	15/1 Coin

The credits given are selectable by means of switches 1-5 incl., for coin chute #1 and switches 9-13 incl., for coin chute #3. Thirty-one different credit ratios are available for each coin chute. The switch settings and resultant credits/coin are listed below.

CREDITS/COIN ADJUSTMENTS

COIN CHUTE #1 (HINGE SIDE) OR #3 (RIGHT SIDE)		SWITCHES				CREDITS	CREDITS	CREDITS	CREDITS	CREDITS	TOTAL CREDITS/COINS
5	4	3	2	1							
13	12	11	10	9							
OFF	OFF	OFF	OFF	OFF	1/1 Coin						
OFF	OFF	OFF	OFF	ON	2/1 Coin						
OFF	OFF	OFF	ON	OFF	3/1 Coin						
OFF	OFF	OFF	ON	ON	4/1 Coin						
OFF	OFF	ON	OFF	OFF	5/1 Coin						
OFF	OFF	ON	OFF	ON	6/1 Coin						
OFF	OFF	ON	ON	OFF	7/1 Coin						
OFF	OFF	ON	ON	ON	8/1 Coin						
OFF	ON	OFF	OFF	OFF	9/1 Coin						
OFF	ON	OFF	OFF	ON	12/1 Coin						
OFF	ON	OFF	ON	OFF	14/1 Coin						
OFF	ON	OFF	ON	ON	1/2 Coins*						
OFF	ON	ON	OFF	OFF	2/2 Coins*						
OFF	ON	ON	OFF	ON	3/2 Coins*						
OFF	ON	ON	ON	OFF	4/2 Coins*						
OFF	ON	ON	ON	ON	5/2 Coins*						
ON	OFF	OFF	OFF	OFF	6/2 Coins*						
ON	OFF	OFF	OFF	ON	7/2 Coins*						
ON	OFF	OFF	ON	OFF	8/2 Coins*						
ON	OFF	OFF	ON	ON	9/2 Coins*						
ON	OFF	ON	OFF	OFF	12/2 Coins*						
ON	OFF	ON	OFF	ON	14/2 Coins*						
ON	OFF	ON	ON	OFF	1/1st Coin	2/2nd Coin					3/2
ON	OFF	ON	ON	ON	0/1st Coin*	1/2nd Coin	1/3rd Coin	1/4th Coin			3/4
ON	ON	OFF	OFF	OFF	0/1st Coin*	1/2nd Coin	0/3rd Coin**	2/4th Coin			3/4
ON	ON	OFF	OFF	ON	1/1st Coin	1/2nd Coin	1/3rd Coin	2/4th Coin			5/4
ON	ON	OFF	ON	OFF	1/1st Coin	2/2nd Coin	1/3rd Coin	3/4th Coin			7/4
ON	ON	OFF	ON	ON	1/1st Coin	2/2nd Coin	2/3rd Coin	2/4th Coin			7/4
ON	ON	ON	OFF	OFF	0/1st Coin***	0/2nd Coin***	1/3rd Coin				1/3
ON	ON	ON	OFF	ON	0/1st Coin**	0/2nd Coin**	0/3rd Coin**	1/4th Coin			1/4
ON	ON	ON	ON	OFF	0/1st Coin****	0/2nd Coin****	0/3rd Coin****	0/4th Coin****	1/5th Coin		1/5
ON	ON	ON	ON	ON	0/1st Coin***	0/2nd Coin***	1/3rd Coin	0/4th Coin****	1/5th Coin		2/5

*No Credits until 2nd coin is dropped.
**No Credits until 4th coin is dropped
***No Credits until 3rd coin is dropped.
****No Credits until 5th coin is dropped.

MAXIMUM CREDITS:

The maximum credits accepted by the machine limits the number of games that can be accumulated by coining, by winning replays or both. The maximum number of credits is selectable by means of switches 25 and 26. Four credit limits are available. Switch settings are listed below.

MAXIMUM CREDITS	SWITCHES 26	25
10	OFF	OFF
15	OFF	ON
25	ON	OFF
40	ON	ON

BALLS PER GAME:

# BALLS / GAME	SWITCHES 32	31
5	OFF	ON
4	ON	OFF
3	OFF	OFF
2	ON	ON

MATCH FEATURE:

When the Match Feature is ON, a random number appears on the Match/Ball in Play window and the word Match is illuminated. If the number matches the tens digit in a player's score, a free game is awarded. The Match Feature creates an incentive to play.

MATCH	SWITCH 28
ON	ON
OFF	OFF

CREDIT DISPLAY:

CREDITS DISPLAYED	SWITCH 27
YES	ON
NO	OFF

HIGH SCORE FEATURE:

The game is designed to award an Extra Ball or Free Game at each of the two or three score levels. See Front Door Game Adjustments.

AWARD	SELF TEST POSITION 16	SELF TEST POSITION 17
REPLAY	SET TO "03"	SET TO "03"
EXTRA BALL	SET TO "02"	SET TO "02"
NOVELTY	SET TO "01"	SET TO "01"
NO AWARD	SET TO "00"	SET TO "00"

For combinations of replay/X-ball/Novelty Modes see page 4A "K. Special Replay/X-ball/Novelty Modes"

HIGH SCORE TO DATE OR OVER 10,000,000 SCORE FEATURE:

The game is designed to award free games as an option if high score to date is beat or player exceeds 10,000,000 points. Each time this happens, the winning score becomes the new high score to beat. This score is displayed on all 4 player score displays at the end of each game as an incentive to play. Recommended setting is underlined.

HIGH SCORE TO DATE FEATURE	SELF TEST POSITION 19
No Award	SET TO "00"
One Credit	SET TO "01"
Two Credits	SET TO "02"
Three Credits	SET TO "03"

State and local laws may regulate the use of the above features, and they have been designed to allow for appropriate adjustment in order to conform to such requirements.

SOUND OPTION

The game is designed to make several tones and noises to announce power-up, game-up, etc. The tones are intended to attract attention to the game and increase game usage. The tones are controlled by pressing self-test button until the #18 shows on the match/ball in play display. Now pulse replay button to desired sound setting.

Setting "00," "01"
Most switches associated chimes wihtout feature background.

Setting "02"
Most scoring will have noise effect without background.

Setting "03"
Most all scoring will have a noise effect with background.

NOTE: To correct clarities of speech and sound, adjust controls as follows:
—Turn remote volume control on front door all the way up.

—Turn the speech volume control on the printed circuit board full clockwise, then counterclockwise until speech is clear and understandable.

—Turn the sound volume control full clockwise, then turn counterclockwise until sound is not garbled.

—Then adjust remote volume control to desired volume level.

GAME FEATURE OPTIONS

2X, 3X, 4X, 5X bonus lite adjustment:
Liberal	SW. 6 ON	Any lit bonus lite will come on for next ball.
Conservative	SW. 6 OFF	Any lit bonus lite will not come on for next ball.

All bonus lite adjustment:
Liberal	SW. 7 ON	Any lit bonus lites will come on for next ball.
Conservative	SW. 7 OFF	Only 20, 40 or 60 lit bonus lites will come on for next ball.

Right 4 drop targets reset adjustment:
Liberal	SW. 8 ON	Only targets dropped down in sequence 1-3 will drop down for next ball.
Conservative	SW. 8 OFF	Any targets down will reset for next ball.

In-line drop target feature lite adjustment:
Liberal	SW. 14 ON	Any feature lite ON will come ON for next ball.
Conservative	SW. 14 OFF	Any feature lite ON will reset to 10 for next ball.

Captive 1-4 Orbs lite adjustment:
Liberal	SW. 15 ON	Any lites ON will come ON for next ball.
Conservative	SW. 15 OFF	Any lites ON will not come ON for next ball.

Guardian Orb liberal—conservative:
Liberal	SW. 16 ON	Making all 4 lites releases a ball every time.
Conservative	SW. 16 OFF	Making all 4 lites releases 1 ball per ball only.

Last ball release liberal—conservative:
Liberal	SW. 21 ON	On last ball release lite will come ON and stay ON.
Conservative	SW. 21 OFF	On last ball release lite will come ON and go ON and OFF.

Orbs initialization:
Liberal	SW. 22 ON	#1 Orbs lite will be ON at start of game.
Conservative	SW. 22 OFF	#1 Orbs lite will not be on at start of game.

Game Over tilt:
Liberal	SW. 23 ON	Regular standard player tilt.
Conservative	SW. 23 OFF	Player may tilt 1st time and keep on playing; Tilting 2nd time keeps player out of the game.

Right target release lite adjustment:
Liberal	SW. 24 ON	Release lite ON will come ON for next ball.
Conservative	SW. 24 OFF	Release lite ON will not come ON for next ball.

Number of games replays per game adjustment:
Liberal	SW. 29 ON	All replays earned will be collected.
Conservative	SW. 29 OFF	Only 1 replay per player per game.

Game Over animation:
	SW. 30 ON	5 balls will kick to playfield every 15 minutes.
	SW. 30 OFF	No kickout of balls.

C. FRONT DOOR GAME ADJUSTMENTS

High Score Feature Adjustments:

The game is designed to award an extra ball (option) or a free game at each of three score levels. The recommended levels are on the score card in the game.

Any level from 10,000 to 9,990,000 can be set, as desired. It is also possible to reset or turn off (00) any or all of the levels, if desired.

1. Push and release Self-Test button (See Figure III) at one second intervals approximately six times or until identification number 01 appears on the 'Match/Ball in Play' display.

2. The number on the Player Score Displays is the score level.* It can be increased, if desired, by holding the credit button in. To decrease the score level, hold the credit button in and depress and release the Self-Test button. Release the credit button when the desired number appears. Note that the level changes 10,000 points at a time. If the number '00' is left on the displays, the high score feature is eliminated for that level.

3. Repeat steps 1 and 2 for the second and third score levels. The identification numbers '02' and '03' on the Match/Ball in Play display are for the second and third levels, respectively.

High Score to Date and 10,000,000 Feature:

The game is designed to award free games when 'High Score to Date' is beat, or if the player exceeds 10,000,000 points.

It is recommended that the level, which will build with play, be periodically reset to the factory recommended level to encourage game play. The adjustment procedure is the same as for the High Score Feature Adjustment, Steps 1 and 2. Continue pushing the Self-Test button until the identification number '04' appears on the 'Match/Ball in Play' display and then do Step 2.

Any level from '00' to 9,990,000 can be set as described. It is to be noted that '00' does NOT turn off the feature, as it does on High Score feature. The feature is turned off by self test position 19 as discussed under 'Back Box Game Admustments'.

SELF TEST SETUP FOR 16-22:

To set up positions 16-22 push and release self test button till 16 shows on match/ball in play. Now pulse replay button for recommended setup from "00" thru "03." Repeat for positions 17, 18, 19 or 22. Positions 20, 21 setups go from "00" thru "15."

SOUND

In addition to individual volume controls for speech and other game sounds on the Squawk and Talk Board. There is also a Master Volume Control located on the front door. (refer to page 10)

Please note that these module volume controls should be adjusted prior to setting the control on the front door.

*Can be quickly set to '00' by pressing S33 on the MPU assembly in the back box or Coin Chute switch #3. (See Figure III).
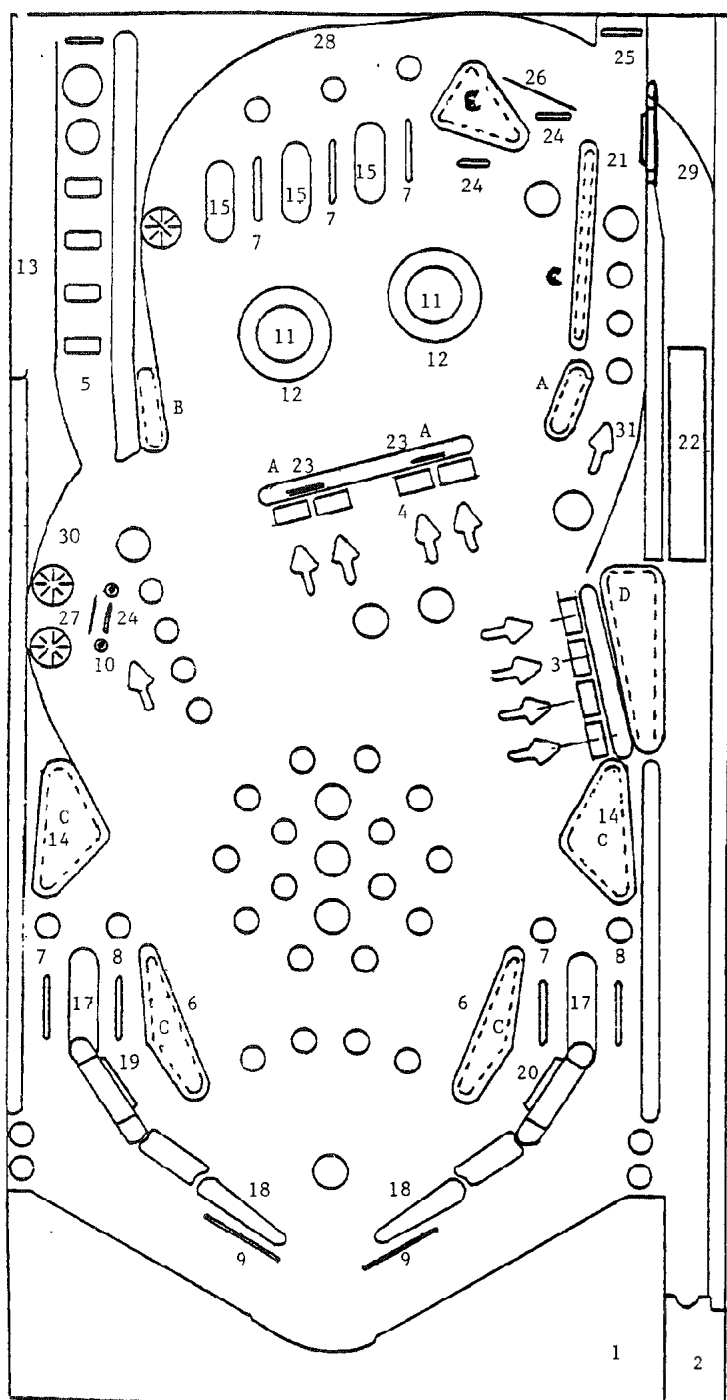
#1239 CENTAUR

RUBBER PARTS

A.	R-521	¾" (3)
B.	R-521-1	1" (1)
C.	R-521-3	2" (6)
D.	R-521-4	2½" (1)
E.	R-521-2	1½" (1)
F.	R-243	5/16" (18)
G.	R-533-1	FLIPPER (2)

PANEL TOP PARTS

1.	Bottom Arch	P-5871-88
2.	Shooter Gauge	P-6359-53
3.	Drop Target/Memory	ASE-3038-5
4.	Drop Target Assm.	ASE-2795-90
5.	4-In-Line Target Assm.	ASE-2993-19
6.	Slingshot Assm.	ASE-2593-6
7.	Wire Actuator Assm.	ASE-2806-26 (5)
8.	Wire Actuator Assm.	ASE-2806-24 (2)
9.	Ball Guide Wire	M-121-53 (2)
10.	Mini Post & Bumper Assm.	ASE-2836-2 (3)
11.	Bumper Cap (Red S/B)	C-1014-1
12.	Bumper Collar (Red S/B)	C-1018-1
13.	Clear Plastics (Set)	A-2890-156
14.	Screened Plastics (Set)	A-2890-155
15.	Guide Rail (1½F)	C-693-11
16.	Guide Rail (1½H)	C-694-11
17.	Guide Rail (2½F)	C-702-11
18.	Molded Flipper (Black)	A-3994-8 (2)
19.	Ball Gate & Wire Assm.	ASE-2250-97
20.	Ball Gate & Wire Assm.	ASE-2250-98
21.	Ball Gate & Wire Assm.	ASE-2250-99
22.	Ball Exit Cover	P-1973-502
23.	Target Switch	A-3359-15 (2)
24.	Target Switch Assm.	ASE-2911-20 (3)
25.	Target Switch Assm.	ASE-2911-3
26.	Ball Guide Wire	M-121-45
27.	Ball Guide Wire	M-121-32
28.	Ball Guide	A-3032-76
29.	Ball Guide	A-3032-74
30.	Ball Guide	A-3032-77
31.	Ball Guide	A-3032-75
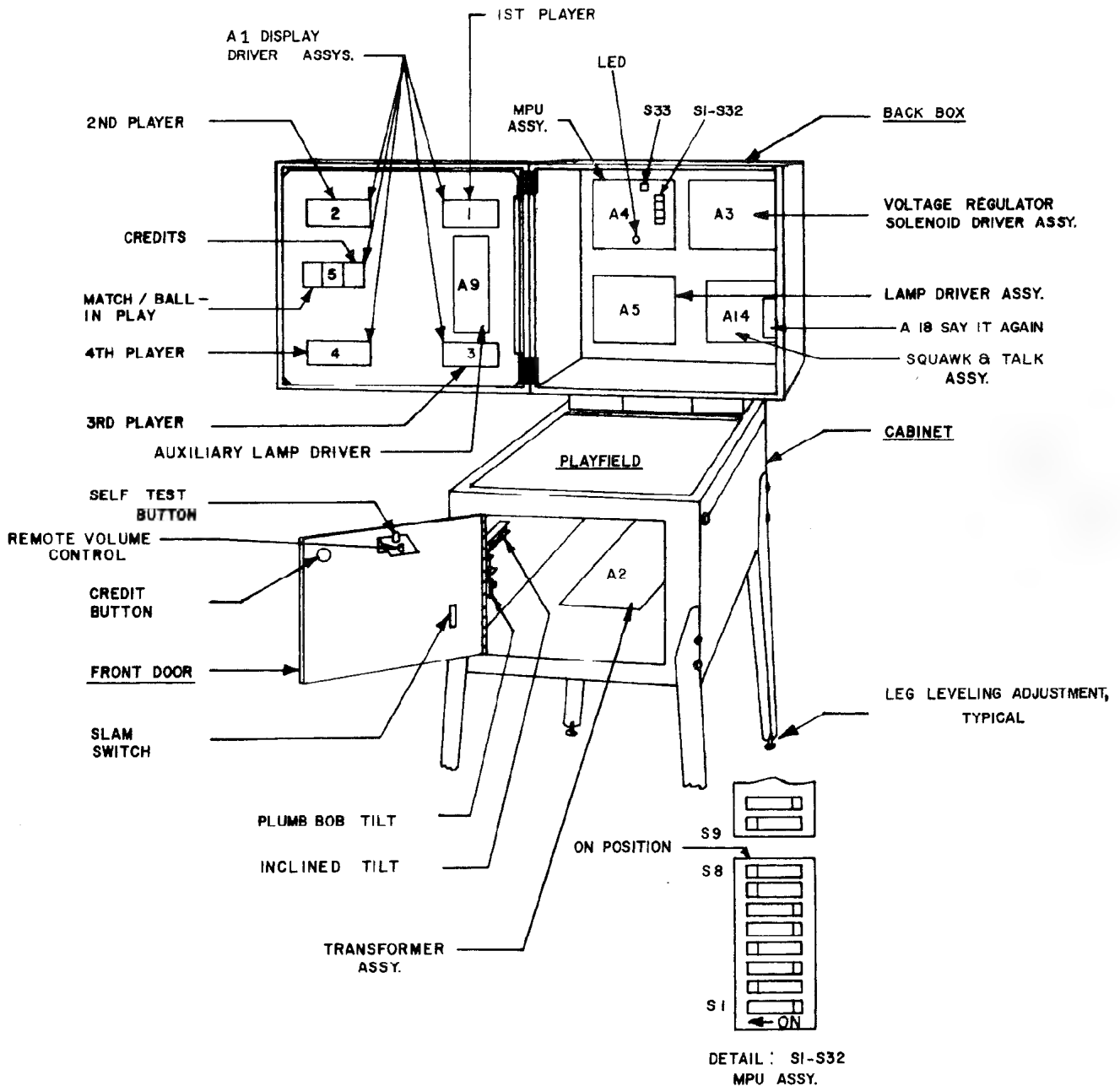
FIGURE III. ELECTRONIC PIN BALL MACHINE

RECOMMENDED

Instructions, Score Cards and High Score Feature Settings
to be used on CENTAUR #1239

3-BALL

REPLAY

Instruction Card	M-1508-102-E
Score Card	M-1508-102-B W/P-1

1 Replay at 1,200,000
1 Replay at 2,800,000

5-BALL

REPLAY

Instruction Cards	M-1508-102-E
Score Card	M-1508-102-A W/T1

1 Replay at 1,500,000
1 Replay at 2,700,000

EXTRA BALL

Instruction Card	M-1508-102-F
Score Card	M-1508-102-A W/NN

1 Extra Ball at 1,000,000
1 Extra Ball at 2,000,000

ADDITIONAL CARDS

REPLAYS

M-1508-H-1	700,000	1,600,000
M-1508-I-1	800,000	1,800,000
M-1508-J-1	900,000	2,000,000
M-1508-K-1	1,000,000	2,200,000
M-1508-L-1	1,000,000	2,400,000
M-1508-M-1	1,100,000	2,300,000
M-1508-N-1	1,100,000	2,500,000
M-1508-O-1	1,200,000	2,600,000
M-1508-P-1	1,200,000	2,800,000
M-1508-Q-1	1,300,000	2,800,000
M-1508-R-1	1,400,000	3,000,000
M-1508-S-1	1,500,000	2,500,000
M-1508-T-1	1,500,000	2,700,000
M-1508-U-1		
M-1508-V-1		
M-1508-W-1		
M-1508-X-1		
M-1508-Y-1		
M-1508-FF-1		
M-1508-GG-1		
M-1508-HH-1		
M-1508-II-1		

EXTRA BALL

M-1508-NN-1	1,000,000	2,000,000
M-1508-OO-1	1,100,000	2,300,000
M-1508-PP-1	1,200,000	2,500,000
M-1508-QQ-1	1,300,000	2,800,000

Instruction Card, Novelty
M-1508-102-G

BLANKS (3)
High game to date recommended levels;
(reset periodically)

3 BALL 3,300,000
5 BALL 3,200,000

#1239 CENTAUR
RECOMMENDED SETTINGS

RECOMMENDED REPLAY GAME SETTING FOR:

		3-BALL	5-BALL
2X, 3X, 4X, 5X BONUS LIGHT	SW. 6	ON	OFF
ALL BONUS LITES	SW. 7	ON	OFF
RIGHT 4 DROP TARGETS RESET	SW. 8	OFF	OFF
IN-LINE DROP TARGET FEATURE	SW. 14	ON	OFF
CAPTIVE 1-4 ORBS LIGHT	SW. 15	ON	OFF
GUARDIAN ORB LIB-CON	SW. 16	OFF	OFF
LAST BALL RELEASE LIB-CON	SW. 21	ON	OFF
ORB INITIALIZATION	SW. 22	ON	ON
GAME OVER TILT	SW. 23	ON	ON
RIGHT TARGET RELEASE LIGHT	SW. 24	ON	OFF
NUMBER OF REPLAYS PER GAME	SW. 29	ON	ON
GAME OVER ANIMATION	SW. 30	ON	ON
BALLS PER GAME	SW. 31	OFF	ON
BALLS PER GAME	SW. 32	OFF	OFF

	3-BALL	5-BALL
REPLAY		
Instruction Card	M-1508-102-E	M-1508-102-E
Score Card	M-1508-102-B W/P-1	M-1508-102-A W/T-1
Major Mode	Self Test Position 16, 17 Set to "03"	Self Test Position 16, 17 Set to "03"
Match	SW. 28 ON	SW. 28 ON
High Score to Date	Self Test Position 19 Set to "03"	Self Test Position 19 Set to "03"
X-BALL		
Instruction Card		M-1508-102-F
Score Card		M-1508-102-A W/NN-1
Major Mode		Self Test Position 16, 17 Set to "02"
Match		SW. 28 OFF
High Score to Date		Self Test Position 19 Set to "00"
NOVELTY		
Instruction Card	M-1508-102-G	M-1508-102-G
Major Mode	Self Test Position 16, 17 Set to "01"	Self Test Position 16, 17 Set to "01"
Match	SW. 28 OFF	SW. 28 OFF
High Score to Date	Self Test Position 19 Set to "00"	Self Test Position 19 Set to "00"

VIII. ROUTINE MAINTENANCE ON LOCATION:

Self-Test routines are written into the game design. They are particularly useful for routine maintenance. The tests are described below. The first test is automatic and occurs on power-up. This test causes the MPU module A4 to examine itself for failures. Seven flashes of an LED indicates proper operation. The second series of self-diagnostic tests causes the MPU to 'exercise' each of the other modules in such a way as to make their faults, if any, obvious. See Figure III and Page ii.

It is recommended that these tests be used several times a week to check out the games before play. If faults are discovered, they may be corrected on location if the operator has a stock of replacement modules. See "Trouble Shooting on Location."

MPU Module Self-Test:

At power on, the LED on the MPU module flashes once. (Flicker-Flash). After a pause, it flashes six more times and goes out. A power-up tune is played to announce game readiness. This indicates proper MPU operating condition and successful completion of the power-up test.

Game Self-Diagnostic Tests:

1. Pressing the Self-Test button inside the door initiates the Self-Test routine. See Figures III and IV. All switched lamps flash off and on continuously.

2. Pressing the Self-Test button again causes each digit on each display to cycle from 0 thru 9, and repeat continuously.

3. Pressing the Self-Test button again causes each solenoid to be energized, one at a time, in a continuous sequence. Hold both flipper buttons 'in' during this test. The number appearing on the Player Score displays is the same as the number assigned to the solenoid. The sound of a solenoid pulling-in as a number appears indicates proper operation. The absence of sound is improper. If sound is absent, see Page 17 for help in Solenoid identification.

4. Pressing Self-Test button again causes the sound module to play the "Game Over" tune repeatedly.

5. Pressing the Self-Test button again causes the MPU to search each switch assembly for stuck contacts. If any are found, the number of the first set encountered is flashed on the Player Score displays. The number remains until the fault is cleared. See Page 17 for help in Stuck Switch identification. Other numbers may follow if more stuck contacts are present. If there are no stuck switches, the Match/Ball in Play display flashes '0'.

6. Pressing the Self-Test button 22 more times causes the MPU to step thru the threshold and bookkeeping functions described previously and finally to repeat the power-up test. For more rapid exit to power-up, turn the game off, then on. The game is now ready to play.

After successful completion of the Self Diagnostic Test procedure, set the game up for play. Exercise each rollover, thumper-bumper, slingshot, etc., by hand until each switch assembly on the playfield has been checked for proper operation. If actuating a switch assembly results in intermittent or no response, clean contacts by gently closing them on a clean business card or piece of paper and wiping until they wipe clean. Regap, if necessary, to 1/16". **Do not burnish or file Gold Plated Switch Contacts.**

IX. TROUBLESHOOTING ON LOCATION

The game is designed to make troubleshooting easy. Several simple procedures are given herein that cover the greatest percentage of game failures. They are written for an operator on location and require module replacement. (See Figure III) Symptoms and the action to be taken are given for each type of problem.

If the problem is more complicated and is not solved by following this procedure, more detailed procedures are available from Bally. See the Parts List for ordering information.

FIGURE IV   SELF DIAGNOSTIC TEST

```
┌─────────────────────────┐
│        ROUTINE          │
│   MAINTENANCE CHECK     │
└─────────────────────────┘
             │                              ┌──────────────────────────────────┐
             ▼◄─────────────────────────────│            REFER TO              │◄──────┐
┌─────────────────────────┐                 │ 'TROUBLE SHOOTING ON LOCATION'  │       │
│       POWER-UP:         │                 │         CORRECT FAULT           │       │
│    TURN OFF POWER       │                 └──────────────────────────────────┘       │
│    TURN ON POWER        │                                                            │
└─────────────────────────┘                                                            │
             │                                                                         │
             ▼                                                                         │
┌─────────────────────────┐   NO                                                       │
│     LED ON MODULE       │──────────   SEE SYMPTOM #1, PAGE 15  ─────────────────────►│
│    A4 FLASHES 7X        │                                                            │
└─────────────────────────┘                                                            │
             │ YES                                                                      │
             ▼                                                                         │
┌─────────────────────────┐                                                            │
│  PRESS SELF-TEST BUTTON │                                                            │
│ ON INSIDE OF FRONT DOOR │ (1)                                                        │
│TO ENTER LAMP DRIVER MODULE TEST│                                                     │
└─────────────────────────┘                                                            │
             │                                                                         │
             ▼                                                                         │
┌─────────────────────────┐   NO                                                       │
│  ALL FEATURE LAMPS LIGHT,│──────────  SEE SYMPTOM #2, PAGE 15  ─────────────────────►│
│   FLASH ON AND OFF?     │                                                            │
└─────────────────────────┘                                                            │
             │ YES                                                                      │
             ▼                                                                         │
┌─────────────────────────┐                                                            │
│ PRESS SELF-TEST BUTTON (AGAIN)│ (2)                                                  │
│TO ENTER DISPLAY DRIVER MODULE TEST│                                                  │
└─────────────────────────┘                                                            │
             │                                                                         │
             ▼                                                                         │
┌─────────────────────────┐   NO                                                       │
│   ALL DISPLAYS COUNT    │──────────   SEE SYMPTOM #3, PAGE 15  ─────────────────────►│
│   0000000 to 9999999    │                                                            │
└─────────────────────────┘                                                            │
             │ YES                                                                      │
             ▼                                                                         │
┌─────────────────────────┐                                                            │
│ PRESS SELF-TEST BUTTON (AGAIN)│ (3)                                                  │
│TO ENTER SOLENOID DRIVER MODULE TEST│                                                 │
└─────────────────────────┘                                                            │
             │                                                                         │
             ▼                                                                         │
┌─────────────────────────┐   NO                                                       │
│  ALL SOLENOIDS * PULL-IN**│──────────  SEE SYMPTOM #4, PAGE 16  ────────────────────►│
│     IN SEQUENCE?        │                                                            │
└─────────────────────────┘                                                            │
             │ YES   ┌──────────────────────────────┐                                 │
             ▼──────►│PRESS SELF-TEST BUTTON (AGAIN)│ (4)                             │
                     │ TO ENTER SOUND MODULE TEST   │──────┐                          │
                     └──────────────────────────────┘      │                          │
┌─────────────────────────┐     ┌──────────────────────────────┐                     │
│PRESS SELF-TEST BUTTON (AGAIN)│◄─│   SOUND MODULE PLAYS        │◄────────────────────┘
│ TO ENTER STUCK-SWITCH TEST│(5) │     "GAME OVER" TUNE        │
└─────────────────────────┘  YES └──────────────────────────────┘
             │                          │ NO   SEE SYMPTOM #5, PAGE 16 ──────────────►
             ▼                                                                         
┌─────────────────────────┐   NO                                                       
│   ALL SWITCHES* OPEN?   │──────────   SEE SYMPTOM #6, PAGE 16  ──────────────────────►
└─────────────────────────┘                                                            
             │ YES                                                                      
             ▼                                                                         
┌─────────────────────────┐
│ PRESS SELF-TEST BUTTON 22 X│
│OR TURN POWER OFF AND THEN ON.│ (6)
│   GAME READY TO PLAY.   │
│REPEAT ENTIRE TEST IF REPAIR WAS MADE.│
└─────────────────────────┘
```

*SOLENOID AND STUCK-SWITCH NUMBER IS FLASHED ON PLAYER
SCORE DISPLAYS AS AN AID IN TROUBLESHOOTING
See page 17.
**HOLD FLIPPER BUTTONS IN DURING TEST.

1A) SYMPTOM: Game does not play power-up tune when power is turned on. General Illumination is present.

ACTION: **A)** Turn power OFF. Open back box. Locate light emitting diode (LED) on MPU module A4.

B) Turn Power ON. LED must flash 7X to indicate that module A4 is good. Correct flash sequence is flicker/flash-pause-and then six more flashes and LED goes out.

C. If LED does not come on, or does not flash, or flashes, but less than 7X, turn off power. Replace MPU module A4.

CAUTION: **Replacement MPU Module must have same Part Number or incorrect operation will result! See Parts List for MPU Module Part Number.**

Turn power ON.

D) If game is correct, it is now ready for play. If game is not correct, refer to Module Replacement procedure. (See Parts List.)

2A) SYMPTOM: Not all feature lamps light during game play.

ACTION: **A)** With power ON, open front door. Press button (Self-Test switch) once. If the game is correct, **all** feature lamps flash ON and OFF.

B) Carefully raise playfield or open back box to gain access to lamps.

C) Replace bulbs that do not flash.

D) If game is correct, it is now ready for play.

E) If game is not correct, turn power OFF. Replace Lamp Driver Module A5. Turn power ON and repeat A.

F) If game is correct, if is now ready for play.*

G) If game is not correct, turn power OFF. Replace MPU module A4. See CAUTION, 1C. Turn power ON and repeat A.

H) If game is correct, it is now ready for play.* If game is not correct, refer to Module Replacement procedure. (See Parts List.)

2B) SYMPTOM: One or some switched lamps always ON.

ACTION: Repeat 2AA, AB, AE, and AF and, if necessary AG & AH.

3A) SYMPTOM: Display digits improper on **one** or **several,** but less than all Display Driver module(s), A1. Improper: One or several segments always OFF, digits mottled or several segments or digit(s) always ON.

ACTION: **A)** With power ON, open front door. Press button (Self-Test switch) twice. If the game is correct, each digit on each Display Driver Module A1 (5 used/game) displays the count 1-9 and 0 continuously in all 6 digit positions. Note defective Display Driver modules.

B) Turn power OFF

CAUTION: High Voltage is supplied to the Display Driver Modules, A1, from the Solenoid Driver/Voltage Regulator Module A3. Wait 30 seconds for High Voltage to Bleed Off.

C) Replace Display Driver module(s) A1. Turn power ON. Repeat A.

D) If game is correct, it is now ready to play.* If game is not correct, refer to Module Replacement procedure. (See Parts List.)

3B) SYMPTOM: **All** displays improper (all five display Driver modules). Improper: Digit(s) always on or off/segment(s) always on or off, all displays.

ACTION: **A)** Repeat 3AA, and AB.

B) Replace MPU module A4. See CAUTION NOTE, 1C. Turn power ON. Repeat A.

3C)
SYMPTOM: One or several displays always off.
ACTION:
  A) Do 3AA, AB, AC, and AD.
  B) Repeat 3BB and BC, if necessary.

4A)
SYMPTOM: Solenoid(s) do(es) not pull-in during course of game.
ACTION:
  A) With power ON, open front door. Press button (Self-Test switch) three times.
  B) If game was correct, each solenoid would be energized. A number is flashed on the Player Score displays as each solenoid is pulsed. Note any numbers that do not have the sound of a solenoid associated. See Solenoid Identification Table. Page 17 and Figure V.
  C) Carefully lift the playfield (or open the back box) to gain access to the solenoid. Turn power OFF. Inspect the solenoid.
  D) If a lead is broken off, repair. Repeat A & B. If game is correct, it is now ready for play.* If solenoid wiring was correct, turn power OFF.
  E) Replace Solenoid Driver/Voltage Regulator module A3. See CAUTION NOTE 3AB.
  F) Repeat AA & AB. If game is correct, it is now ready to play.* If game is not correct, turn power OFF.
  G) Replace Sound Module A8.
  H) Repeat AA and AB if game is correct. It is now ready to play. If game is not correct, turn power OFF."
  I) Replace MPU module A4. See CAUTION NOTE, 1C.
  J) Repeat A & B. If game is correct, it is now ready to play.* If game is not correct, refer to Module Replacement Procedure. (See Parts List.)

4B)
SYMPTOM: Solenoid(s) always energized—Note: if impulse solenoids (ball ejects, slingshots, thumper-bumpers, etc.) are energized continuously, they are subject to damage. Limit troubleshooting to one minute with power ON, followed by **five minutes with power OFF.** Repeat as necessary. Replace damaged solenoids.
ACTION: Do 4AA, AB, AE, AF, AG, AH and if necessary, AI and AJ.

5)
SYMPTOM: No Sound.
ACTION:
  A) With Power ON, open front door, press Self-Test switch four times.
  B) Turn volume control clockwise to Max.
  C) If correct, sound will be heard. If incorrect, try seating speaker lead connector (J2) and input connector (J1).
  D) If correct, sound will be heard. If incorrect, refer to Module Replacement procedure.

6)
SYMPTOM: Feature (Drop Targets, etc.) does not score.
ACTION:
  A) With power ON, open front door. Press button (Self-Test switch) five times.
  B) If the game is correct, Match/Ball in Play display would flash '0.' If a number appears on the Player Score displays, see Switch Assembly Identification Table. Page 17 and Figure V.
  C) Carefully lift the playfield. Locate the switch assembly identified from the number. Visually inspect the switch assembly. If the contacts are 'stuck,' regap them to 1/16". See section under ADJUSTMENTS. Repeat A & B. If the game is correct, it is now ready to play.* If game is not correct, turn the power OFF.
  D) Replace MPU module A4. See CAUTION NOTE 1, C.
  E) Repeat A & B. If the game is correct, it is now ready to play.* If the game is not correct, refer to Module Replacement Procedure. (See Parts List.)

7)
SYMPTOM: Game blows fuse(s) repeatedly.
ACTION: See Module Replacement Procedure. F.O. 560

C) If game is correct, it is now ready to play.* If game is not correct, refer to Module Replacement procedure. (See Parts List.)

*Turn power On-Off switch OFF and then ON.

GAME #1239 CENTAUR
SOLENOID IDENTIFICATION TABLE

Self Test #	SOLENOID IDENTIFICATION	Self Test #	SOLENOID IDENTIFICATION
01	OUTHOLE KICKER	10	RIGHT 4 DROP TARGET "1" (TOP)
02	KNOCKER	11	RIGHT 4 DROP TARGET "2"
03	INLINE DROP TARGET RESET	12	RIGHT 4 DROP TARGET "3"
04	4 RIGHT DROP TARGET RESET	13	RIGHT 4 DROP TARGET "4" (BOTTOM)
05	LEFT THUMPER BUMPER	14	BALL RELEASE
06	RIGHT THUMPER BUMPER	15	BALL KICK TO PLAYFIELD
07	LEFT SLINGSHOT	16	COIN LOCKOUT DOOR
08	RIGHT SLINGSHOT	17	K1 RELAY (FLIPPER ENABLE)
09	ORBS TARGET RESET	18	MAGNET

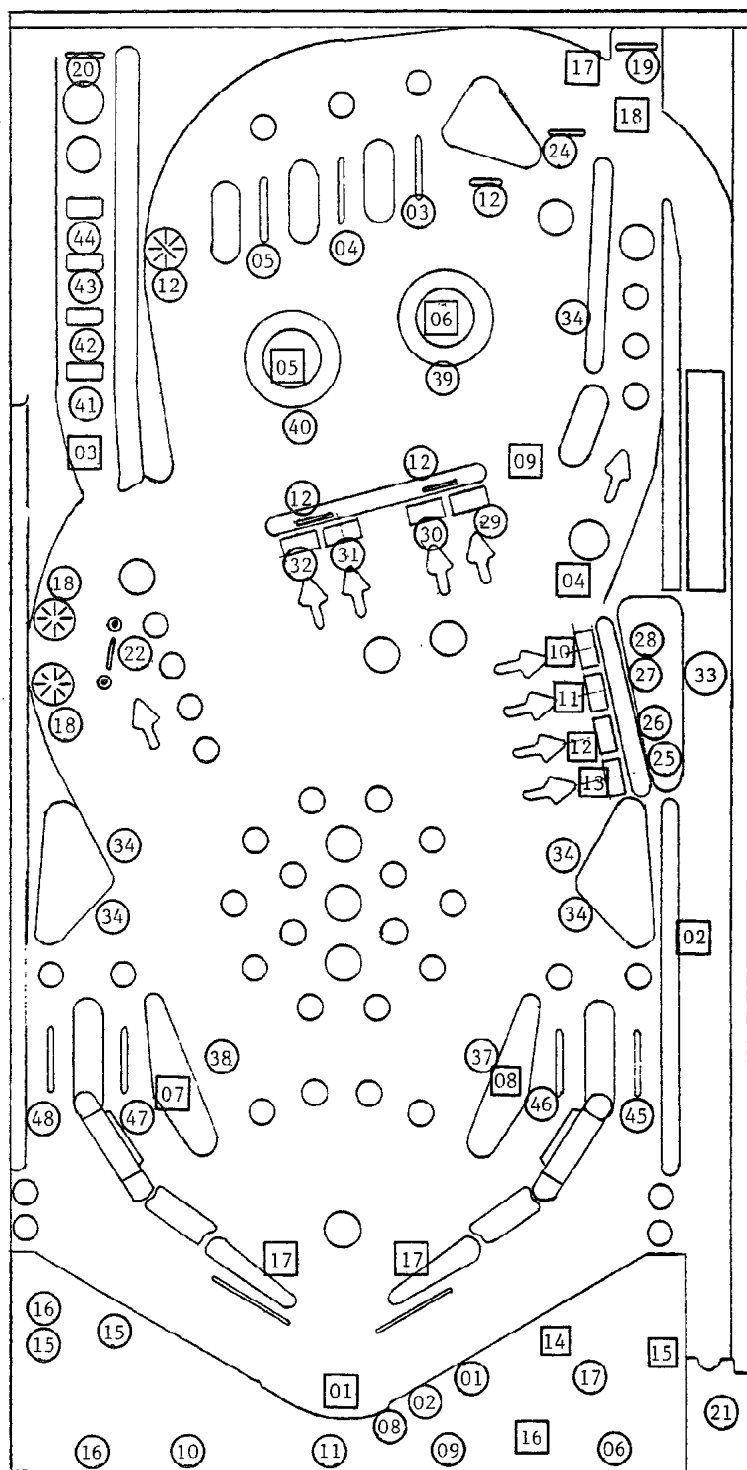| Switch Self Test #	DESCRIPTION	Switch Self Test #	DESCRIPTION
01	4TH BALL TROUGH	25	RIGHT 4 DROP TARGET "4" (BOTTOM)
02	5TH BALL TROUGH	26	RIGHT 4 DROP TARGET "3"
03	TOP RIGHT LANE	27	RIGHT 4 DROP TARGET "2"
04	TOP MIDDLE LANE	28	RIGHT 4 DROP TARGET "1' (TOP)
05	TOP LEFT LANE	29	"S" DROP TARGET
06	CREDIT BUTTON	30	"B" DROP TARGET
07		31	"R" DROP TARGET
08	OUTHOLE	32	"O" DROP TARGET
09	COIN III (RIGHT)	33	END OF TROUGH
10	COIN I (LEFT)	34	10 POINT REBOUND (5)
11	COIN II (MIDDLE)	35	
12	TOP LEFT LANE R.O. BUTTON ORBS 2 BACK TARGETS TARGET BEHIND RIGHT THUMPER BUMPER	36	
		37	RIGHT SLINGSHOT
13		38	LEFT SLINGSHOT
14		39	RIGHT THUMPER BUMPER
15	TILT (3)	40	LEFT THUMPER BUMPER
16	SLAM (2)	41	1ST INLINE DROP TARGET
17	1ST BALL TROUGH	42	2ND INLINE DROP TARGET
18	LEFT SIDE R.O. BUTTON (2)	43	3RD INLINE DROP TARGET
19	ORBS RIGHT LANE TARGET	44	4TH INLINE DROP TARGET
20	INLINE BACK TARGET	45	RIGHT OUTLANE
21	LEFT & RIGHT FLIPPER BUTTON	46	RIGHT RETURN LANE
22	RESET 1-4 TARGETS, TARGET	47	LEFT RETURN LANE
23		48	LEFT OUTLANE
24	TOP SPOT 1-4 TARGET		

FIGURE V

#1239 CENTAUR

⭕ INDICATES SWITCH ASSEMBLY
IDENTIFICATION NUMBERS
NOTE: CABINET: 15, 16, 21
DOOR: 06, 09
                           10, 11, 16

⬜ INDICATES SOLENOID
IDENTIFICATION NUMBERS
NOTE: DOOR: 16
            BACKBOX: 17
            CABINET: 02

ASSEMBLY ADJUSTMENTS:

GENERAL:

All switch assemblies consist of leaf springs, contacts, separators, plastic tubing and screws to hold them to the mounting surface. Before attempting to adjust a switch assembly, make sure that these screws are tight. If not, tighten screw closest to the contact end of the leaf spring first. This will prevent the assembly from being secured in such a manner that the leaf springs tend to fan out. In general, all leaf springs are adjusted for a 1/16" gap in the open position and .010" overtravel or wipe in the closed position. All contacts should be in good condition. Unless otherwise instructed, they should be dry or non-lubricated. All contacts should be free of dust and dirt. Contacts, with the exception of the flipper button switch assemblies, are plated to resist corrosion. Filing or burnishing breaks the finish and encourages corrosion. Clean by closing the contacts over a clean piece of paper (e.g. a business card) and wiping gently until the contacts are clean. For the flipper button switch assemblies **ONLY:** Tarnish can be removed with a contact file followed by a burnishing tool. Severely pitted contacts must be replaced as an assembly. In general, contacts need be cleaned or replaced and adjusted only when they are found to be a source of game malfunction.

X. SERVICE PARTS:

A parts catalogue is available upon request. The catalogue is illustrated and lists all replacement parts for each game manufactured by Bally. Requests should be addressed to:

> BALLY MANUFACTURING CORPORATION
> 2640 WEST BELMONT AVENUE
> CHICAGO, ILLINOIS 60618
> ATTN: PARTS DEPARTMENT

SERVICE HINTS:

The Bally playfield has an improved tuff-coat finish with excellent wearing properties. Its life expectance, as well as play appeal, can be extended by periodic cleaning of the playfield.

DO: Bally recommends you clean your playfield with Wildcat #125 (Wildcat Chemical Co., 1333 W. Seminary Drive, Ft. Worth, Texas 76115). Wildcat #125 is a combination cleaner and polish. Bally has tried and tested this product and found it to be very effective. If Wildcat #125 is not available, Bally suggests you ask your Distributor to order it. Inspect and hand polish the ball in a clean cloth. A chipped ball must be replaced. It can ruin the finish on the playfield in a short period of time.

DON'T: Use water in large quantities, highly caustic cleaners, abrasive cleaners or cleaning pads on the playfield. Do not allow a wax or polish build up. Waxes yellow with age and spoil play appeal.

XI. PARTS LIST
#1239 CENTAUR

MISCELLANEOUS	PART NUMBER
Transformer (Domestic or Export)	E-122-142
Bulbs, #555	E-125-73
Fuse, 1 Amp. 3 AG Slow Blow (Playfield Solenoid Protection)	E-133-44

ASSEMBLY COILS

Coin Lockout	FO-36-7000
Flipper (2)	AQ-25-500/ 34-4500
Knocker	AR-26-1200
Outhole Kicker	AN-26-1200
Thumper Bumper (2)	AN-26-1200
Sling-Shot (2)	AO-26-1200
Drop Target Reset (3)	NO-26-1900
Individual Drop Target (4)	CJ-31-2000
Kick to Playfield	AO-25-950
Magnet	E-184-284
Ball Release	AO-27-1300

PLAYFIELD PARTS

See Figure II

MODULES

Lamp Driver A5	AS-2518-23
Display Driver A1 (1 used)	AS-2518-21
Display Driver A1 (4 used)	AS-2518-58
Solenoid Drive/Voltage Regulator A3	AS-2518-22
MPU A4	AS-2962-30
Transformer & Rectifier A2	AS-2877-6
Rectifier Board (Part of A2)	AS-2518-54
Squawk & Talk	AS-3107-7
Auxiliary Lamp Driver A9	AS-2518-43
Solenoid Expander	AS-2518-66
Aux. Driver (G.I. Flasher)	AS-2518-68

REPAIRS PROCEDURES/AIDS

|	
Module & Component Replacement	F.O.560-1
AID (Assistance in Diagnostics)	
Kit, used with F.O.560-1	KIT #485-1

MODULE COMPONENTS
SEE MODULE PARTS LIST

MODULE COMPONENT STARTER KITS
(Each kit contains an assortment of the most needed electronic parts for use in Module repair.)
KIT #558—For Rectifier Board (Part of A2)
KIT #503—For MPU Board A4 (less Memory U1-U6)
KIT #492—For Solenoid Driver/Voltage Regulator A3
KIT #493—For Display Driver A1
KIT #494—For Lamp Driver A5

AS-2518-35   MPU MODULE
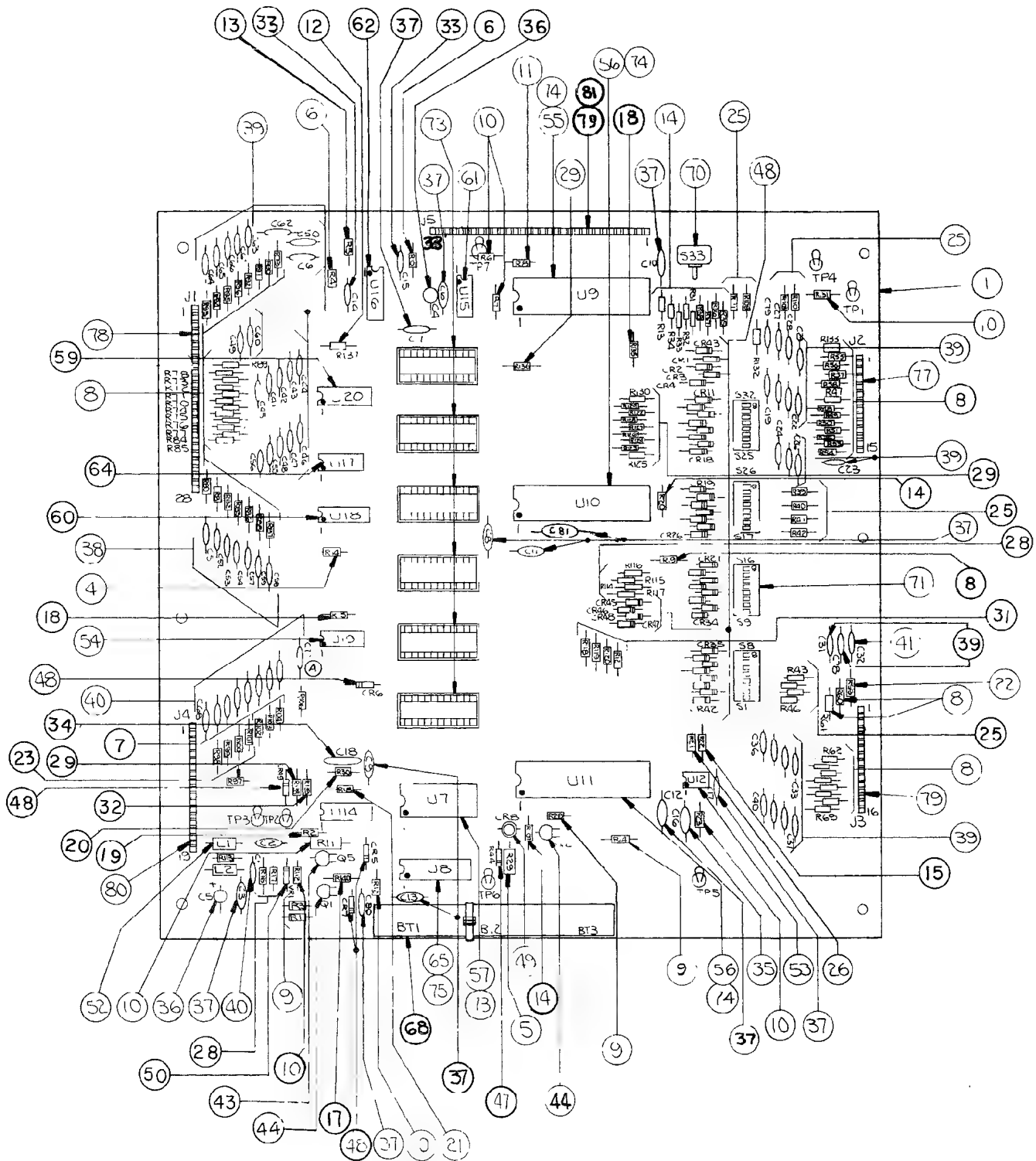
# A4: MPU MODULE
COMPONENT PARTS LIST

ITEM	REFERENCE DESIGNATION	BALLY PART #	DESCRIPTION
1	A4 (see note 1)	AS-2962-30	MPU Module Complete.
2	A4 (see note 2)	AS-2518-35	MPU Module less Program Memory, U1-6 incl.
3-32	See Schematic		Resistors, See schematic for value
33	C14, C15	E-00586-0067	Capacitor, 470 PFD, 1kv
34	C18	E-00586-0088	Capacitor, .05 MFD, 16V
35	C16	E-00586-0081	Capacitor, .1 MFD, 100V
36	C4, C5	E-00586-0073	Capacitor, 4.5 MFD, 25V
37	C3, C6-C13, C17, C81	E-00586-0085	Capacitor, .01 MFD, 25V
38	C79, C41-C67	E-00586-0083	Capacitor, 470 PFD, 50V
39	C19-C31, C78, C33-C40	E-00586-0082	Capacitor, 390 PFD, 50V
40	C1, C2, C68-C77	E-00586-0084	Capacitor, 820 PFD, 50V
41	C32	E-00586-0077	Capacitor, 3000 PF, 1kv
43	Q5	E-00585-0023	Transistor PNP (MPS-3702)
44	Q1, Q2	E-00585-0031	Transistor (2N3904)
47	CR44	E-00587-0006	Diode (IN4004)
48	CR1-CR7, CR11-CR43, CR45-CR49	E-00587-0014	Diode (IN4148)
49	CR8	E-00679	LED (Green)
50	VR1	E-00598-0008	Diode Zener (8.2V, IN9598)
52	L1, L2	E-00604-0003	Inductor, 22 Micro Hy.
53	U12	E-00620-0004	Timer (555)
54	U19	E-00620-0005	Quad 2 Input (4011)
55	U9	E-00620-0028	MPU I.C. (6800)
56	U10, U11	E-00620-0029	PIA I.C. (6820)
57	U7	E-00620-0030	RAM I.C. (6810)
59	U20	E-00620-0032	HEX Buffer I.C. (14502B)
60	U14, U18	E-00620-0033	HEX Inverter (4049B)
61	U15	E-00620-0034	Quad Memory Drive (MC3459L)
62	U16	E-00620-0035	Dual Monostable (9602)
64	U17	E-00620-0041	Quad 2 Inputs (74L00N)
65	U8	E-00620-0042	RAM (C MOS, P5101L-3)
68	BT1, BT2, BT3	E-00628-0003	Battery
70	S33	E-00658-0001	Push Button Switch
71	S1-S8, S9-S16, S17-S24, S25-S32	E-00677	DIP Switch
73		E-00712	24 Pin Socket
74		E-00712-0001	40 Pin Socket
75		E-00712-0003	22 Pin Socket
77	J2	E-00715	15 Pin Wafer Connector
78	J1	E-00715-0004	28 Pin Wafer Connector
79	J3, J5	E-00715-0017	16 Pin Wafer Connector
80	J4	E-00715-0018	19 Pin Wafer Connector
81	J5	E-00715-0024	17 Pin Wafer Connector

NOTE 1:
When ordering, fill in dash number. For example, AS-2962-0: LOST WORLD, AS-2962-2: SIX MILLION DOLLAR MAN, AS-2962-3: PLAYBOY, AS-2962-4: VOLTAN, AS-2962-5: SUPERSONIC, AS-2962-6: STAR TREK, AS-2962-7: KISS, AS 2962-8: PARAGON, AS-2962-9: GROUND SHAKER, AS-2962-10: HARLEM GLOBETERS, AS-2962-12: DOLLY PARTON, AS-2962-13: SILVERBALL MANIA, AS-2962-18: MYSTIC, AS-2962-20: HOTDOGGIN, AS-2962-22: SKATEBALL, AS-2963-23: FRONTIER, AS-2962 21: XENON, AS-2962-24: FLASH GORDON, AS-2962-26: EIGHT BALL DELUXE, AS-2962-25: FIREBALL II, AS-2962-28: FATHOM, AS-2962-29: MEDUSA, AS-2962-30: CENTAUR

NOTE 2: Order replacement memory chips U1-U6, specifying game, socket and part number stamped on chip.
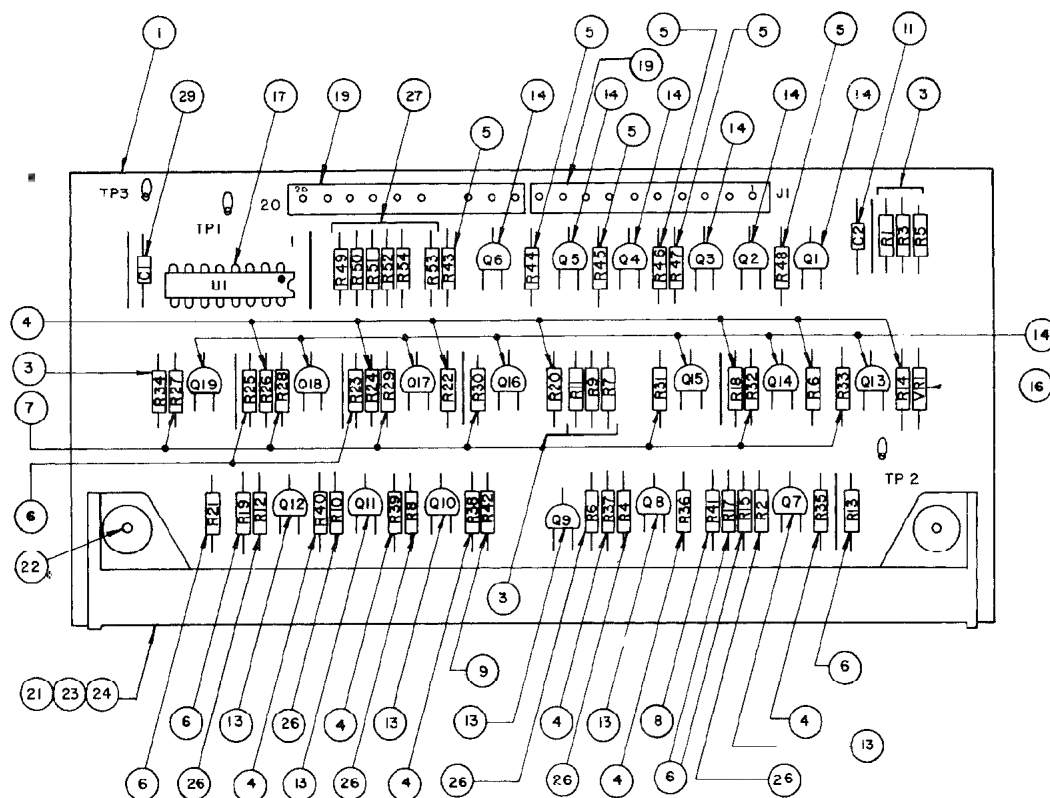
AS-2518-23 LAMP DRIVER MODULE
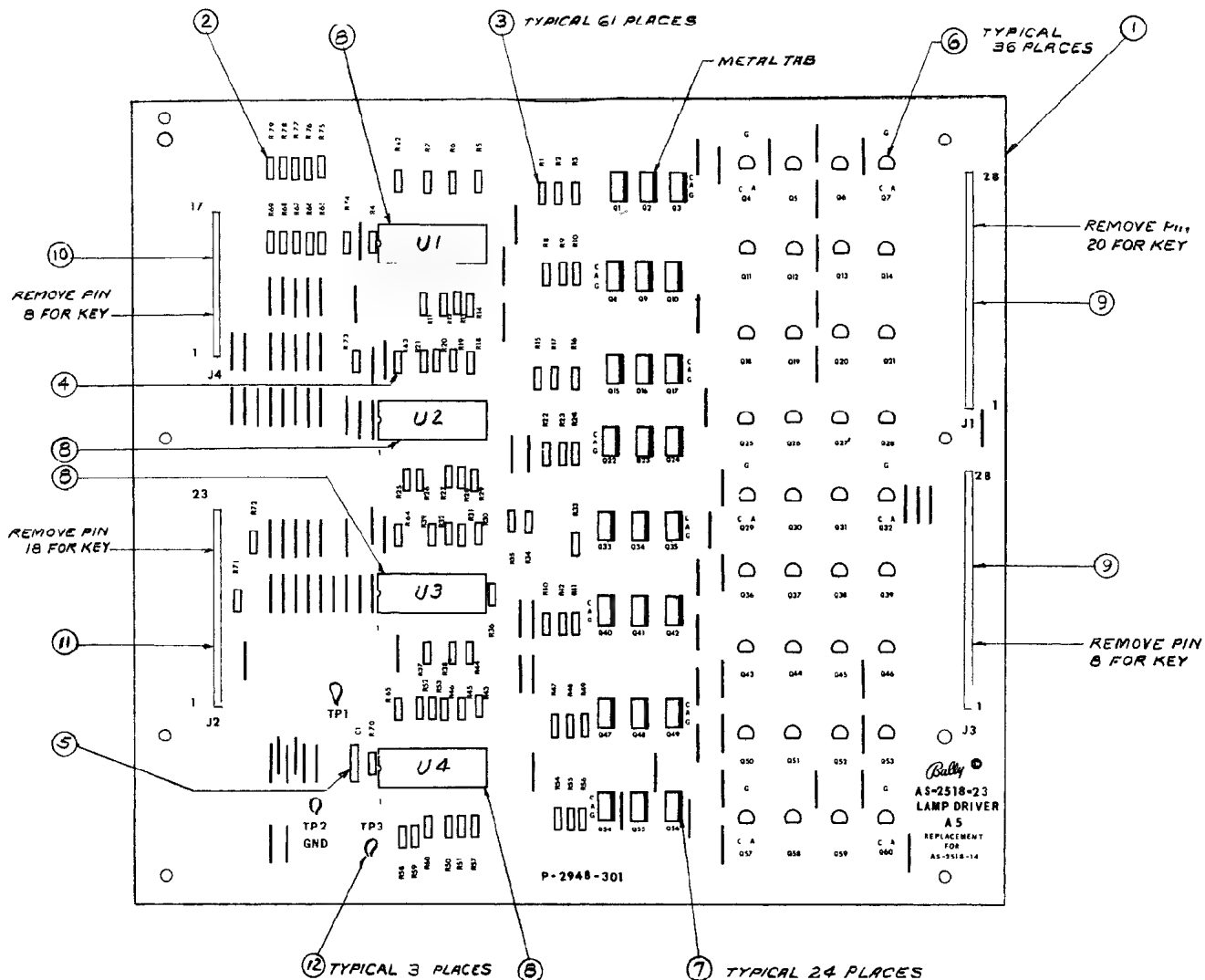
A5: LAMP DRIVER MODULE
COMPONENT PARTS LIST

ITEM	REFERENCE DESIGNATION	BALLY PART #	DESCRIPTION
1	A5	AS-2518-23	Lamp Driver Module, Complete
2	R71-R79	E-00105-242	Resistor, 20kΩ, 5%, ¼ W
3	R1-R60, R70	E-00105-0237	Resistor, 2kΩ, 5%, ¼ W
4	R61-R69	E-00105-0256	Resistor, 2.2MΩ, ¼ W
5	C1	E-00586-0065	Capacitor, .01 MFD, 500V
6	Q4-Q7, Q11-Q14, Q18-Q21, Q25-Q32, Q36-Q39, Q43-Q46, Q50-Q53, Q57-Q60	E-00585-0014	SCR, 2N5060
7	Q1-Q3, Q8-Q10, Q15-Q17, Q22-Q24, Q33-Q35, Q40-Q42, Q47-Q49, Q54-Q56	E-00585-0029	SCR, MCR106-1
8	U1-U4	E-00620-0037	I.C., Decoder, 14514B
9	J1, J3	E-00715-0004	28 Pin Wafer Connector
10	J4	E-00715-0024	17 Pin Wafer Connector
11	J2	E-00715-0014	23 Pin Wafer Connector
12	TP1, TP2, TP3	P-05399	Test Clip

23

AS-2518-21 CREDIT DISPLAY DRIVER MODULE

A1: 6 DIGIT DISPLAY DRIVER MODULE
COMPONENT PARTS LIST

ITEM	QTY.	REFERENCE DESIGNATION	BALLY PART #	DESCRIPTION
1	1	A1	AS-2518-21	6 Digit Display Driver, Complete
3	7	R1, R3, R5, R7, R9, R11, R34	E-105-331	Resistor, 100K Ω
4	13	R14, R16, R18, R20, R22, R24, R26, R35, R36, R37, R38, R39, R40	E-105-227	Resistor, 300K Ω
5	6	R43, R44, R45, R46, R47, R48	E-105-228	Resistor, 9.1K Ω
* 6	7	R13, R15, R17, R19, R21, R23, R25	E-105-229	Resistor, 1.5K Ω
7	7	R27, R28, R29, R30, R31, R32, R33	E-105-222	Resistor, 1.2K Ω
8	1	R41	E-105-231	Resistor, 39K Ω
9	1	R42	E-105-271	Resistor, 240K Ω
10				
11	1	C2	E-586-65	Capacitor, .01 MFD, 500V
13	6	Q7, Q8, Q9, Q10, Q11, Q12	E-585-32	Transistor (2N5401)
14	13	Q1, Q2, Q3, Q4, Q5, Q6, Q13, Q14, Q15, Q16, Q17, Q18, Q19	E-585-33	Transistor (MPS-A42)
16	1	VR1	E-598-7	Zener Diode, 110V
17	1	U1	E-620-38	I.C. Decoder
18				
19	2	J1	E-715-34	10 Pin Wafer Pin Connector
* 21	1	DS1	E-680	Digital Display Panel
22	2		M-1836	Hi-Lo Screw. W/H
23	1		P-2399	Display Mounting (Top)
24	1		P-2399-1	Display Mounting (Bottom)
26	6	R2, R4, R6, R8, R10, R12	E-105-287	Resistor, 2.2K Ω
27	6	R49, R50, R51, R52, R53, R54	E-105-242	Resistor, 20K Ω
28	As Req'd			Wire Jumper
29	1	C1	E-586-85	Capacitor, .01 MFD, 25V

NOTE: INTERCHANGEABLE WITH AS-2518-15

AS-2518-22 SOLENOID DRIVER/VOLTAGE REGULATOR MODULE
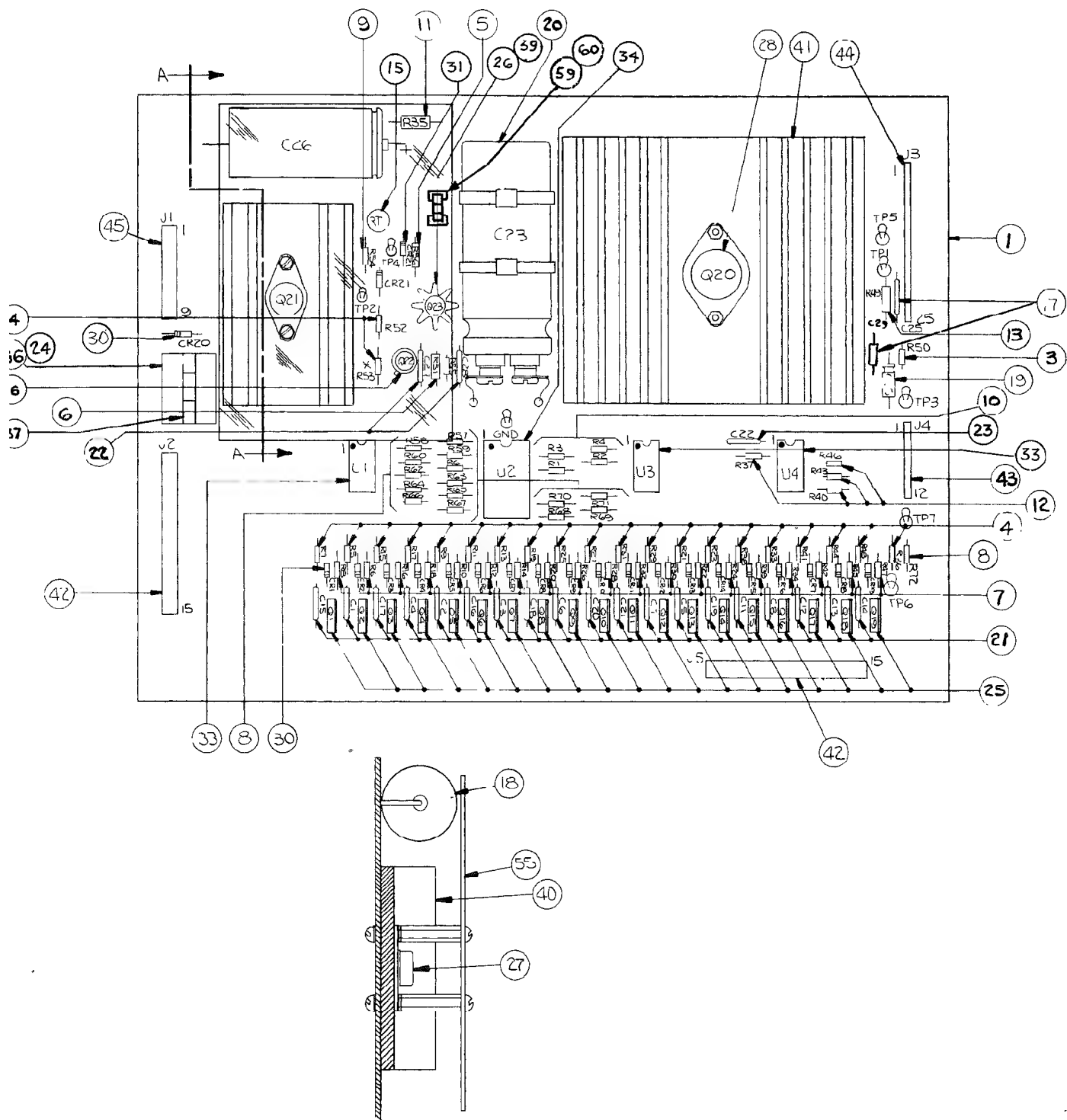

NOTE: INTERCHANGEABLE WITH AS-2518-16

A3: SOLENOID DRIVER/VOLTAGE REGULATOR MODULE

COMPONENT PARTS LIST

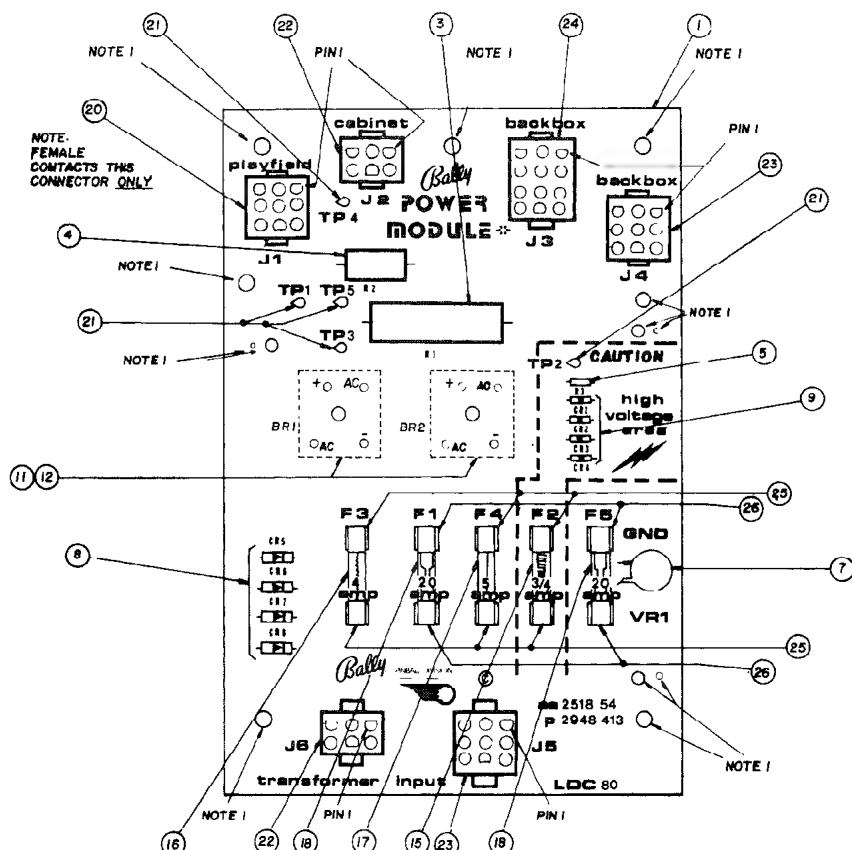| ITEM	REFERENCE DESIGNATION	BALLY PART #	DESCRIPTION
1	A3	AS-2518-22	Solenoid Driver/Voltage Regulator Module, Complete
3-14	Resistors		Resistor, See Schematic for value.
15	RT1	E-00599-0014	Pot. (Linear) 25K
17	C25, 29	E-00586-0014	Capacitor, .1 MFD, 20V
18	C26	E-00586-0059	Capacitor, 160 MFD, 350V
19	C24	E-00586-0063	Capacitor, 2 MFD @ 25V
20	C23	E-00586-0062	Capacitor, 11700 MFD, 20V
21	C1-C8, C11-C21	E-00586-0064	Capacitor, .002 MFD, 1kv
22	C27, C28	E-00586-0065	Capacitor, .01 MFD, 500V
24	K1	E-00146-0795	Relay, Printed Circuit
25	Q1-Q19	E-00585-0034	Transistor, SE9302
26	Q22, Q23	E-00585-0041	Transistor, 2N3440
27	Q21	E-00585-0042	Transistor, 2N3584
28	Q20	E-00710	+5V Regulator, LAS1405 or 78H05KC or LM323K
30	CR1-CR21	E-00587-0015	Diode (IN4004)
31	VR1	E-00598-0010	Diode, Zener 140V, IN5275A
33	U1, U3, U4	E-00681	I.C. Transistor Array, CA3081
34	U2	E-00620-0039	I.C. Binary to 1/16 Decoder, 74L154
36		E-00592-0002*	Relay Socket
37		M-1839*	Relay Holder
39		E-00682	Heat Sink, TO5
40		E-00682-0001	Heat Sink, TO66
41		E-00682-0002	Heat Sink, TO3 Case
42		E-00715-0039	15 Pin Wafer Connector
43		E-00715-0016	12 Pin Wafer Connector
44		E-00715-0020	25 Pin Wafer Connector
45		E-00715-0033	9 Pin Wafer Connctor
55		M-1838	Shield-Plexiglass
59		E-00148-0021	Fuse Clips
60	F1	E-00133-0029	Fuse 8 AG-3/16 Amp.
23	C22	E-00586-0085	Capacitor, .01 MFD, 25V

*USED WITH ITEM 24, E-00146-0791, PLUG IN RELAY ONLY

A2: POWER TRANSFORMER MODULE
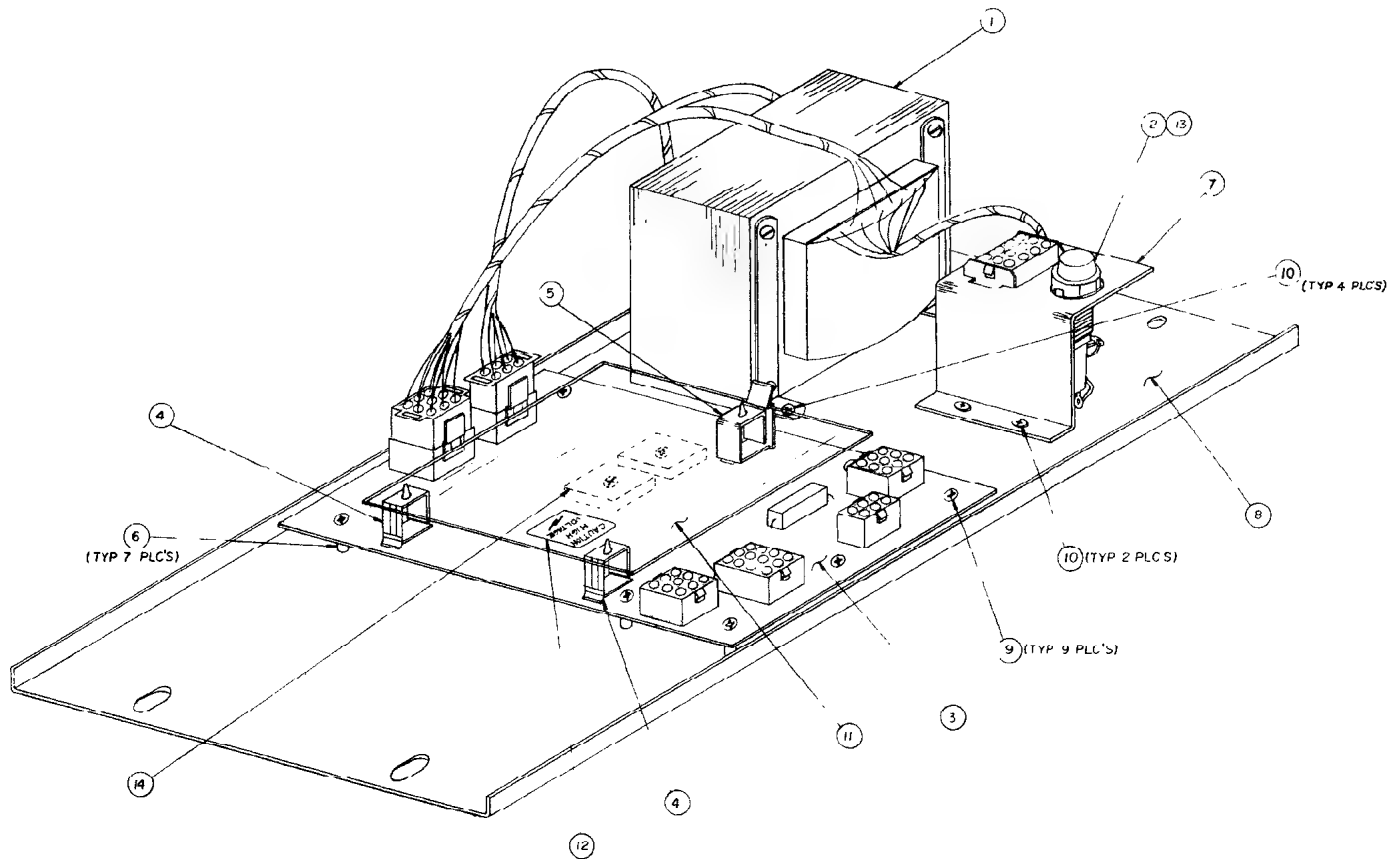
COMPONENT PARTS LIST

ITEM	REFERENCE DESIGNATION	BALLY PART #	DESCRIPTION
0	A2	AS-2877-6	Power Transformer Module, Complete
1		AS-3071-2	Transformer
2		E-148-25	Fuse Holder
3	A2	AS-2518-54	Power Module Assy.
4		M-1829-4	Hinged Support
5		M-1829-3	Edge Holder
6		M-1829-5	Spacer
7		P-6442-244b	Fuse & Connect Brkt.
8		P-6442-246	Chassis
9		RLPP-832-1812	Screw
10		RLPP-1032-1806	Screw
11		P-2692-2	Shield
12		M-469-936a	High Voltage Sticker
13		E-133-24	3A S.B. Fuse
14		M-1834	H. S. Compound

AS-2518-54 RECTIFIER BOARD ASSEMBLY

(Part of) A2: POWER TRANSFORMER MODULE
COMPONENT PARTS LIST

ITEM	REFERENCE DESIGNATION	BALLY PART #	DESCRIPTION
0	A2	AS-2877-6	Power Transformer Module, Complete
1	P/O A2	AS-2518-54	Rectifier Board Assembly, Complete
3	R1	E-00104-0092	Resistor, 10%, 600 Ohm, 10W
4	R2	E-00104-0091	Resistor, 25 Ohm, 5W
5	R3	E-00105-0226	Resistor, 5%, 100K Ohm, ¼W
7	VR1	E-00623	Varistor
8	CR5, CR6, CR7, CR8	E-00587-0022	3A Diode
9	CR1, CR2, CR3, CR4	E-00587-0015	Diode (IN4004)
10			
11	Used with BR1-2	P-1973-480	Spacer
12	BR1, BR2	E-00602-0006	Bridge Rectifier
15	F2	E-00133-0028	Fuse, ¾A, 250V, 3AG
16	F3	E-00133-0004	Fuse, 4A, 32V, 3AG
17	F4 NOTE 1	E-00133-0005	Fuse 5A, 32V, 3AG
18	F1, F5	E-00133-0027	Fuse, 20A, 32V, 3AG
19			
20	J1	E-806-9	9 CKT Socket Header
21	TP1, 2, 3, 4, 5	P-05399	Test Clip
22	J2, J6	E-805-6	6 CKT Pin Header
23	J4, J5	E-805-9	9 CKT Pin Header
24	J3	E-805-12	12 CKT Pin Header
25	F2, 3, 4	E-00148-0021	Fuse Clips
26	F1, 5	E-00148-0022	Fuse Clips (Low Resistance)

NOTE 1—All games with 4 or more flippers use 7A

28

# AS 2518-61B
SQUAWK & TALK MODULE
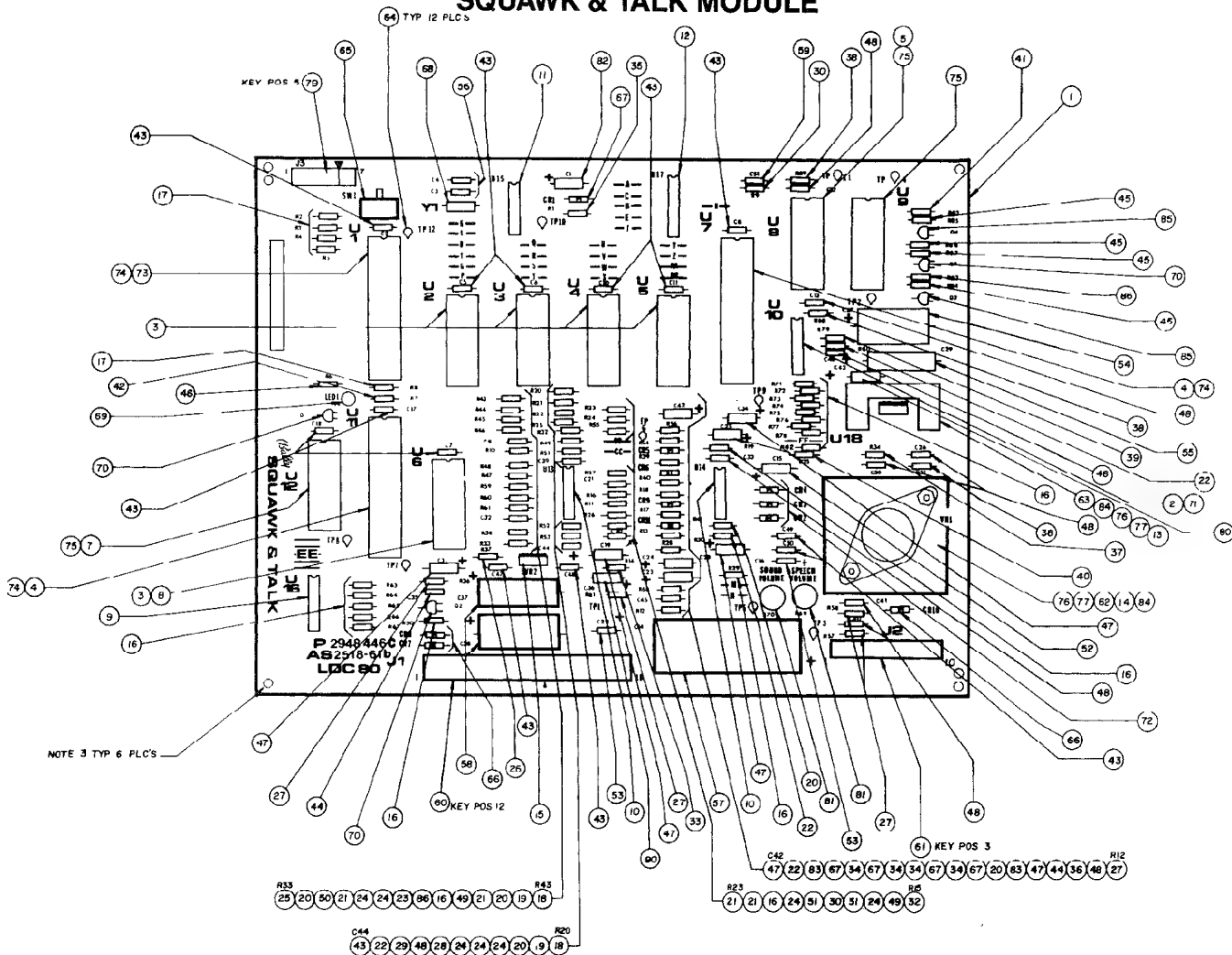
ITEM	QTY.	REFERENCE DESIGNATION	DESCRIPTION	BALLY PART #
1	1	A14	AS 2518-61 B	Squawk & Talk Module, Complete
2	1	U10	AD 558 DAC	E-620-171
3	5	Used with U2 thru U6	24 Pin I.C. Socket	E-712
4	2	U7, U11	6821 P.I.A.	E-620-29
5	1	U8	Tms 5200 Speech	E-620-167
7	1	U12	AY3-8912 Sound	E-620-166
8	1	U6	6810 RAM (SEE NOTE 1)	E-620-30
9	1	U16	4049 Hex Inverter	E-620-33
10	2	U13, U14	LM 3900	E-620-126
11	1	U15	74LS14 Schmidt Inverter	E-620-169
12	1	U17	74LS155	E-620-168
13	1	U18	TDA 2002 Power Amp	E-620-127
14	1	VR1	LM323, 5V Regulator	E-710
15	1	VR2	7905, -5V Regulator	E-620-165
16	19	R10, 19, 29, 42, 50, 63-67, 71-78, 55	Resistor, ¼W, 10K	E-105-185
17	5	R2-5,8	Resistor, ¼W, 5%, 3.3K	E-105-238
18	2	R20, 43	Resistor, ¼W, 5%, 820K	E-105-343
19	2	R21, 44	Resistor, ¼W, 5%, 390K	E-105-310
20	5	R13, 22, 38, 41, 45	Resistor, ¼W, 200K	E-105-225
21	4	R23, 24, 46, 61	Resistor, ¼W, 5% 100K	E-105-226
22	4	R30, 53, 56, 80	Resistor, ¼W, 5% 2K	E-105-237
23	1	R47	Resistor, ¼W, 5%, 2.7K	E-105-151
24	7	R25, 26, 27, 32, 49, 59, 60	Resistor, ¼W, 5% 1m	E-105-285
25	1	R33	Resistor, ¼W, 5%, 91K	E-105-313

COMPONENTS PARTS LIST

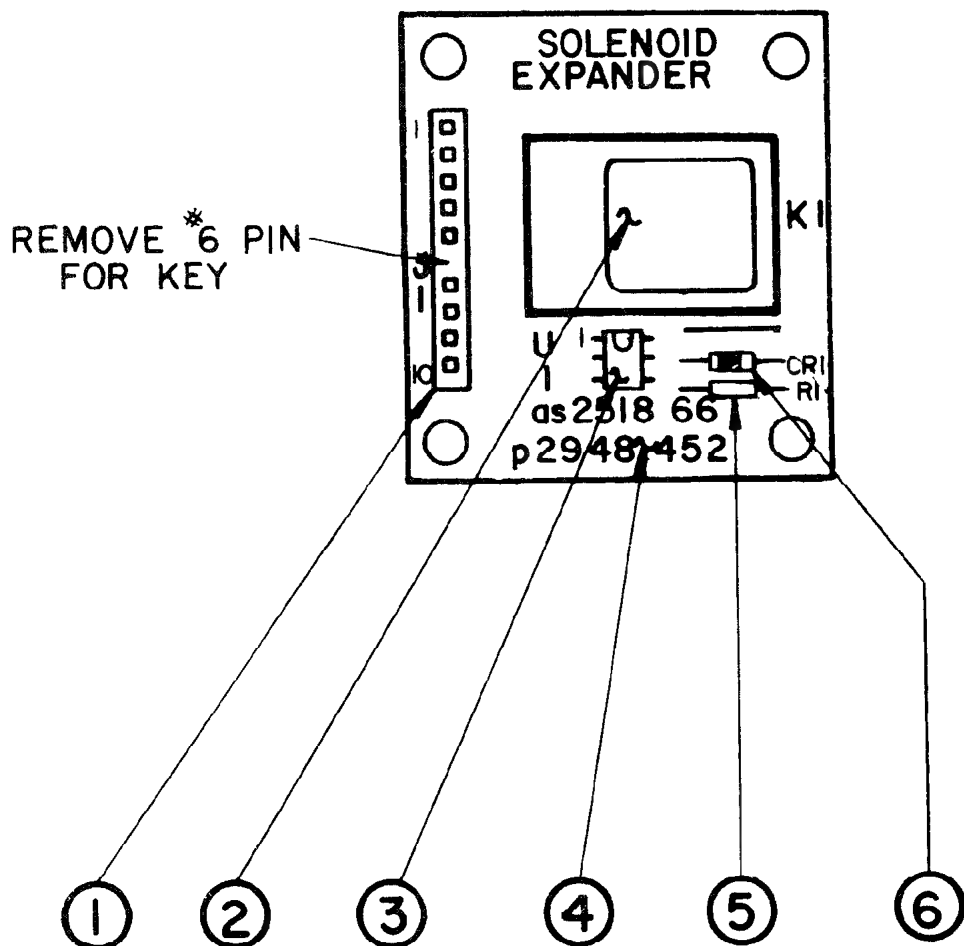| ITEM	QTY.	REFERENCE DESIGNATION	DESCRIPTION	BALLY PART #
26	1	R37	Resistor, ¼W, 5%, 30K	E-105-245
27	5	R12, 36, 57, 58, 81	Resistor, ¼W, 5%, 1K	E-105-230
28	1	R51	Resistor, ¼W, 5%, 750K	E-105-344
29	1	R52	Resistor, ¼W, 5%, 9.1K	E-105-228
30	2	R9, 16	Resistor, ¼W, 5%, 130K	E-105-203
31	1	R11	Resistor, ¼W, 5%, 150K	E-105-248
32	1	R15	Resistor, ¼W, 5%, 220K	E-105-161
33	1	R14	Resistor, ¼W, 5%, 1.8K	E-105-346
34	4	R17, 18, 39, 40	Resistor, ¼W, 5%, 910K	E-105-347
35	1	R1	Resistor, ¼W, 5%, 27K	E-105-243
36	1	R68	Resistor, ¼W, 5%, 510 Ω	E-105-311
37	1	R34	Resistor, ¼W, 5%, 2.2 Ω	E-105-211
38	3	R31, 88, 89	Resistor, ¼W, 5%, 220 Ω	E-105-303
39	1	R79	Resistor, ¼W, 5%, 7.5K	E-105-345
40	1	R35	Resistor, ¼W, 5%, 1 Ω	E-105-196
41	1	R83	Resistor, ¼W, 5%, 11K	E-105-360
42	1	R7	Resistor, ¼W, 5%, 8.2K	E-105-223
43	14	C2, 5-8, 10, 11, 17, 18, 44, 47-50	Capacitor, Ceramic, .01µF, 25V	E-586-85
44	2	C23, 35	Capacitor, Ceramic, .47µF, 16V	E-586-130
45	4	R84-87	Resistor, ¼W, 5%, 2.2K	E-105-287
46	1	R6	Resistor, ¼W, 470Ω	E-105-342
47	7	C19, 24, 25, 28, 31, 34, 42	Capacitor, Electrolytic, 1µF, 25V	E-586-90
48	10	C12, 13, 26, 30, 33, 39, 40, 41, 45, 46	Capacitor, Ceramic, .1µF, 25V	E-586-89
49	2	C9, 20	Capacitor, Ceramic, 470pF, 50V	E-586-83
50	1	C32	Capacitor, Ceramic, 68pF	E-586-120
51	1	C21	Capacitor, Ceramic, 100pF	E-586-68
52	1	C15	Capacitor, Electrolytic, 10µF, 16V	E-586-135
53	2	C16, 22	Capacitor, Tantalum, 4.7µF, 25V	E-586-73
54	1	C27	Capacitor, Electrolytic, 1000µF, 16V	E-586-136
55	1	C29	Capacitor, Electrolytic, 470µF, 6V	E-586-124
56	2	C3, 4	Capacitor, Ceramic, 27pF	E-586-121
57	1	C14	Capacitor, Electrolytic, 4700µF, 25V	E-586-123
58	2	C37, 38	Capacitor, Electrolytic, 330µF, 50V	E-586-147
59	1	C51	Capacitor, Monolythic, 10pF	E-586-150
60	1	J1	18 Pin Wafer Connector (156)	E-736-18
61	1	J2	10 Pin Wafer Connector (156)	E-736-10
62	1	Used with VR1	Heatsink, 6053B	E-682-11
63	1	Used with U18	Heatsink, 6030B	E-682-8
64	12		Test Points	P-5399
65	1	SW. 1	P.C.B. Switch	E-658-1
66	3	CR7, 8, 10	Diode (IN4004)	E-587-15
67	5	CR1, 5, 6, 9, 11	Diode (IN4148)	E-587-14
68	1	Y1	Crystal, 3.579	E-744-5
69	1	LED1	LED	E-679
70	3	Q1-2, 5	Transistor, 2N3904	E-585-31
71	1	Used with U10	Socket I.C. 16 Pin	E-712-16
72	3	CR2-4	Diode, 3A, 50V. min.	E-587-24
73	1	U1	6808 or 6802 (SEE NOTE 1) Microprocessor	E-620-125 or 128
74	3	Used with U1, 7, 11	Socket, I.C. 40 Pin	E-712-1
75	3	Used with U8, 9, 12	Socket, I.C. 28 Pin	E-712-28
76	3	Used with U18, VR1	Screw	LSPR-00632-1106
77	3	Used with U18, VR1	Nut	N-00632-2112
78				
79		J3	Header, 7 Pin	E-766-7
80	2	C36, 43	Capacitor, 2µF, 25V	E-586-63
81	2	R69, 70	Pot. 1K	E-599-16
82	1	C1	Capacitor, Electrolytic, 47µF	E-586-148
83	2	R28, 54	Resistor, 82K	E-105-341
84	AR	Used with U18, VR1	Thermal Compound	M-1834
85	2	Q3, 4	Transistor, 2N4403	E-585-23
86	2	R82, 48	Resistor, ¼W, 5%, 2.4K	E-105-312

JUMPERS — SEE NOTES

AS-2518-43   AUXILIARY LAMP DRIVER
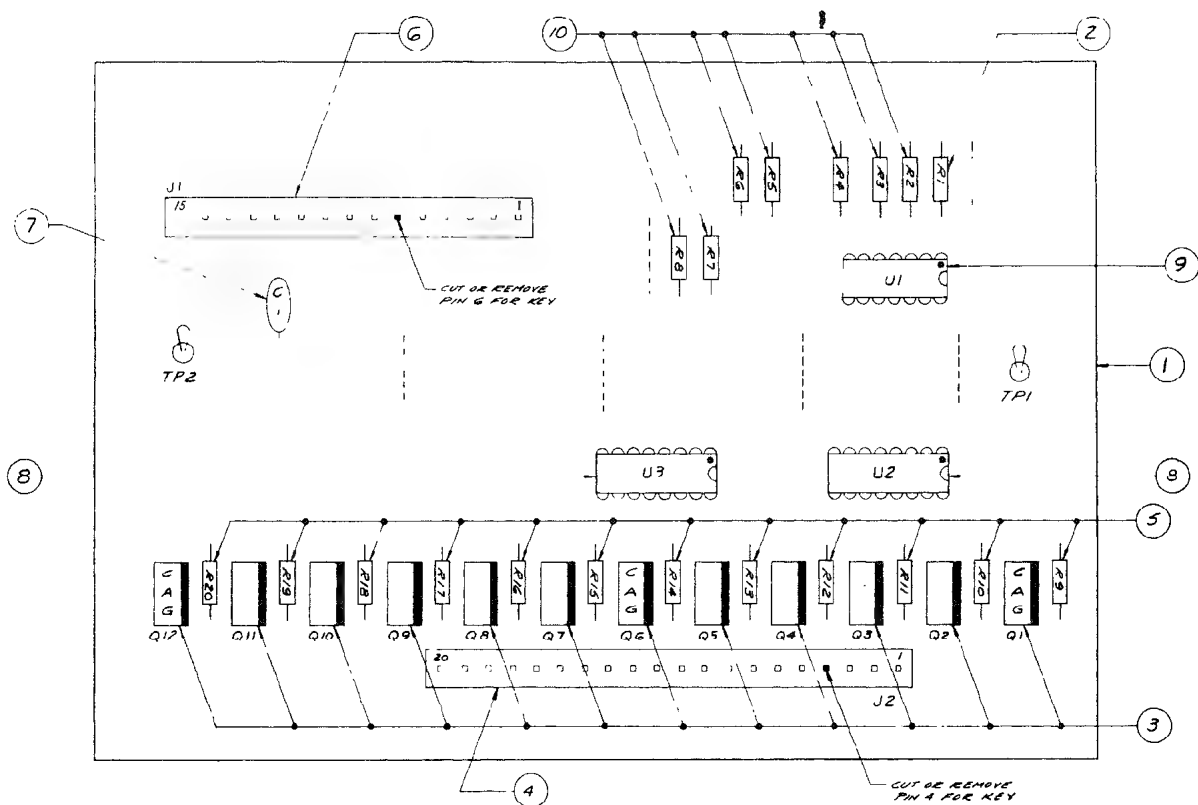
A9: AUXILIARY LAMP DRIVER
COMPONENT PARTS LIST

ITEM	QTY.	REFERENCE DESIGNATION	BALLY PART NO.	DESCRIPTION
1	1	A9	AS-2518-43	Auxiliary Lamp Driver, Complete
2	1	R1	E-105-173	Resistor 2.2 Meg. Ω
3	12	Q1 Thru Q12	E-585-29	SCR MCR 106-1
4	2	J2	E-715-34	10 Pin Wafer Pin Connector
5	12	R9 Thru R20	E-105 237	Resistor 2K Ω
6	1	J1	E-715-39	15 Pin Wafer Pin Connector
7	1	C1	E-00586-0065	Capacitor .01 MFD
8	2	U3, U2	E-620-84	MC14555B Binary 1 to 4
9	1	U1	E-620-85	MC14013B Dual D Flip Flop
10	7	R2 Thru R8	E 105-242	Resistor 20K Ω

A15: SOLENOID EXPANDER ASSEMBLY
AS-2518-66

ITEM	REFERENCE DESIGNATION	BALLY PART #	DESCRIPTION
1	J1	E-736-10	10 Pin 'Molex' KK156
2	K1	E-146-795	48 V. Relay
3	U1	E-620-172	MOC 3011
4	P-2948-452	M-645-585	P.C. Board
5	R1	E-105-219	330 Ohm Resistor
6	CR1	E-587-15	IN4004 Diode
Ref.		W-1251-I	Schematic

A1: 7 DIGIT DISPLAY DRIVER MODULE

COMPONENTS PARTS LIST

ITEM	QTY.	REFERENCE DESIGNATION	BALLY PART #	DESCRIPTION
1	1	A1	AS-2518-58	7 Digit Display Driver, Complete
3	8	R1, R3, R5, R7, R9, R11, R34, R56	E-105-331	Resistor, 100K Ω
4	15	R14, R16, R18, R20, R22, R24, R26, R35, R36, R37, R38, R39, R40, R58, R62	E-105-227	Resistor, 300K Ω
5	7	R43, R44, R45, R46, R47, R48, R55	E-105-228	Resistor, 9.1K Ω
6	9	R13, R15, R17, R19, R21, R23, R25, R61, R60	E-105-229	Resistor, 1.5K Ω
7	7	R27, R28, R29, R30, R31, R32, R33	E-105-222	Resistor, 1.2K Ω
8	1	R41	E-105-231	Resistor, 39K Ω
9	1	R42	E-105-271	Resistor, 240K Ω
10	1	R63	E-105-248	Resistor, 150K Ω
11	1	C2	E-586-65	Capacitor, .01 MFD, 500V
13	7	Q7, Q8, Q9, Q10, Q11, Q12, Q21	E-585-32	Transistor (2N5401)
14	15	Q1, Q2, Q3, Q4, Q5, Q6, Q13, Q14, Q15, Q16, Q17, Q18, Q19, Q20, Q22	E-585-33	Transistor (MPS-A42)
15	2	CR1-2	E-587-14	Diode (IN4148)
16	1	VR1	E-598-7	Zener Diode, 110V (IN3045A)
17	1	U1	E-620-38	I.C. Decoder (MC14543)
18				
19	2	J1	E-736-10	10 Pin Wafer Pin Connector (KK-156)
21	1	DS1	E-680-7	7 Digital Display Panel
22	2		M-1836	Hi-Lo Screw, W/H
23	1		P-2399	Display Mounting (Top)
24	1		P-2399-1	Display Mounting (Bottom)
25	3	TP1-3	P-5399	Test Clip
26	7	R2, R4, R6, R8, R10, R12, R57	E-105-287	Resistor, 2.2K Ω
27	6	R49, R50, R51, R52, R53, R54	E-105-242	Resistor, 20K Ω
28				
29	1	C1	E-586-85	Capacitor, .01 MFD, 25V

"SAY IT AGAIN" MODULE
AS-2518-81
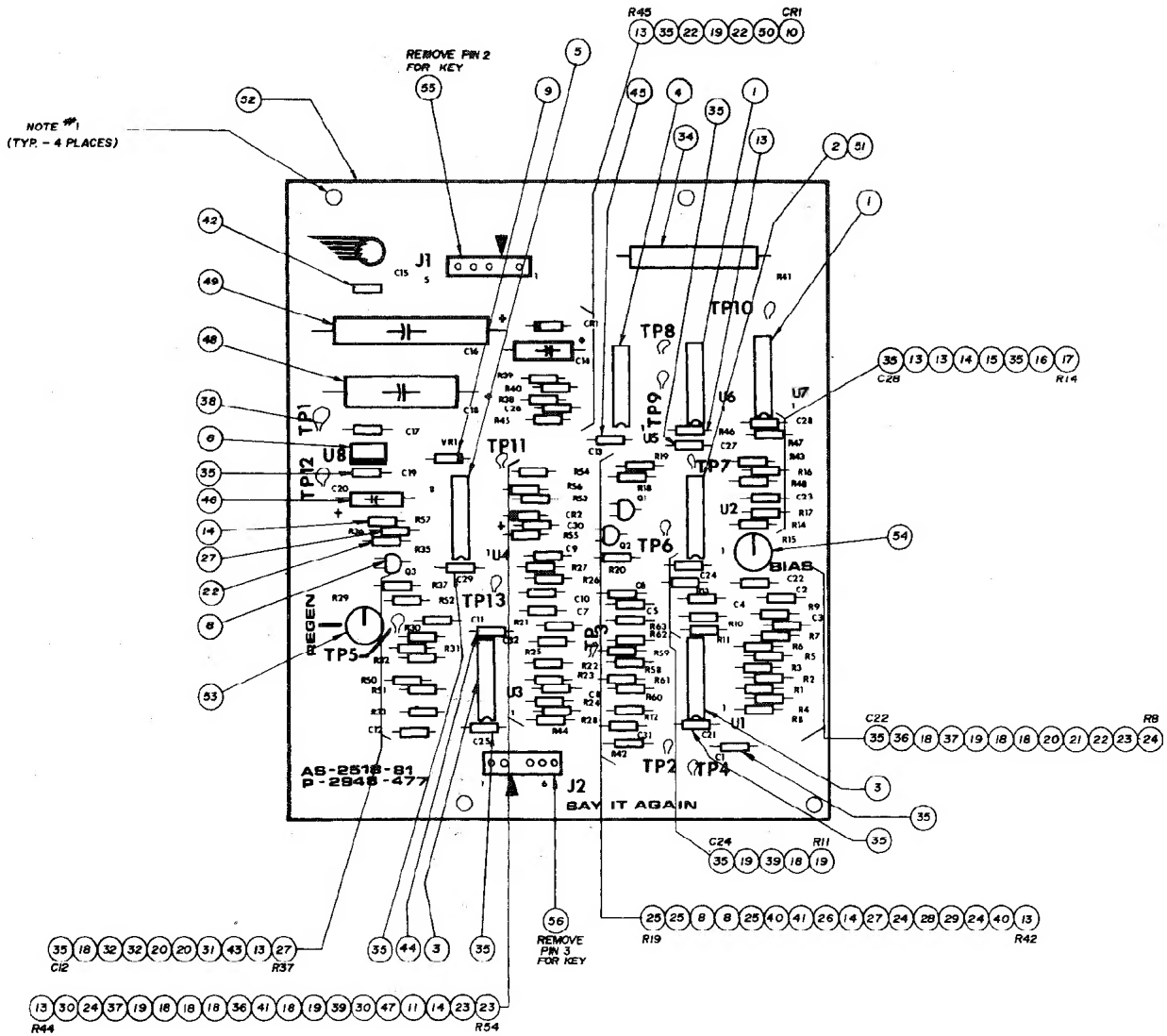
"SAY IT AGAIN" MODULE
AS-2518-81
COMPONENT PARTS LIST

ITEM	REFERENCE DESIGNATION	BALLY PART #	DESCRIPTION
1	U6, U7	E-620-122	Quad Nor Gates 4001
2	U2	E-620-195	Analog Delay Line, SAD 4096
3	U1, U3	E-620-126	Quad OP Amp LM3900
4	U5	E-620-197	Phase Locked Loop, 4046
5	U4	E-620-196	Quad Analog Switch 4066
6	U8	E-620-179	7812 + 12V Regulator
7			
8	Q1-3	E-585-31	Transistor, 2N3904
9	VR1	E-598-22	Zener, 24V, IN5359, 5W
10	CR1	E-587-15	Diode, IN4004
11	CR2	E-587-14	Diode, IN4148
12			
13	R42-47, R52	E-105-306	Resistor, 10Ω, ¼W, 5%
14	R16, 53, 57, 62	E-105-185	Resistor, 10K, ¼W, 5%
15	R48	E-105-346	Resistor, 18K, ¼W, 5%
16	R17	E-105-336	Resistor, 15K, ¼W, 5%
17	R14	E-105-230	Resistor, 1K, ¼W, 5%
18	R5, 6, 9, 10, 21, R25, 33, 22, 26	E-105-382	Resistor, 680K, ¼W, 5%
19	R7, 11, 13, 23, 27, 40	E-105-348	Resistor, 330K, ¼W, 5%
20	R3, 31, 32	E-105-284	Resistor, 470K, ¼W, 5%
21	R2	E-105-343	Resistor, 820K, ¼W, 5%
22	R1, 35, 38, 39	E-105-226	Resistor, 100K, ¼W, 5%
23	R4, 54, 56	E-105-285	Resistor, 1M, ¼W, 5%
24	R8, 12, 24, 58	E-105-380	Resistor, 1.2M, ¼W, 5%
25	R18-20	E-105-377	Resistor, 22K, ¼W, 5%
26	R63	E-105-303	Resistor, 220Ω, ¼W, 5%
27	R36, 37, 59	E-105-263	Resistor, 47K, ¼W, 5%
28	R61	E-105-381	Resistor, 2.4M, ¼W, 5%
29	R60	E-105-378	Resistor, 4.7M, ¼W, 5%
30	R28, 55	E-105-250	Resistor, 1.5M, ¼W, 5%
31	R30	E-105-256	Resistor, 2.2M, ¼W, 5%
32	R50, 51	E-105-379	Resistor, 3.9M, ¼W, 5%
33			
34	R41	E-104-92	Resistor, 600Ω, 10W, 10%
35	C1, 12, 19, 21-29	E-586-89	Capacitor, Disc, .1μF, 25V ± 20%
36	C2, C7	E-586-169	Capacitor, Cer., 680pF, 50V ± 5%
37	C3, C8	E-586-170	Capacitor, Cer., 47pF, 50V ± 5%
38	C17	E-586-100	Capacitor, Cer., 0.1μF, 100V
39	C4, C9	E-586-175	Capacitor, 270pF, 50V ± 5%
40	C6, 31	E-586-112	Capacitor, .033μF
41	C5, C10	E-586-171	Capacitor, 120pF, 50V + 5%
42	C15	E-586-65	Capacitor, .01μF, 500V
43	C11	E-586-118	Capacitor, 0.2μF, 16V ± 20%
44	C32	E-586-155	Capacitor, 68pF, 50V ± 5%
45	C13	E-586-176	Capacitor, 470pF, 50V ± 5%
46	C20	E-586-177	Capacitor, Lytic, 10μF, 25V
47	C30	E-586-73	Capacitor, Tant., 4.7μF, 25V
48	C18	E-586-173	Capacitor, Lytic, 100μF, 100V ± 20%
49	C16	E-586-172	Capacitor, 100μF, 160V, ± 20%
50	C14	E-586-90	Capacitor, 1μF, 25V
51	U/W U2	E-712-16	Socket, 16 Pin
52		P-2948-477	P.C. Board (M-645-612)
53	R29	E-599-21	Trim Pot, 50K
54	R15	E-599-15	Trim Pot, 10K
55	J1	E-736-5	.156 Wafer, 5 Pin
56	J2	E-766-6	.100 Wafer, 6 Pin
57	TP1-13	P-5399	Test Point Loop

SET UP PROCEDURE
FOR
"SAY IT AGAIN" (AS-2518-81) MODULE

Two adjustments are required to establish proper operating conditions for the echo unit. First is the Bias Adjustment which is required to minimize distortion and maximize the signal to noise ratio. The second is the Regeneration Adjustment which sets the number of times the echo will repeat.

To make the Bias Adjustment begin by turning the Speaker Volume Control OFF (fully counterclockwise) or disconnect the leads to the speaker. This is necessary because a loud tone is used for the Bias set up and this tone will be very annoying to listen to. Second, turn the Regeneration Control (R29) OFF (fully counterclockwise), to prevent the regenerated signal from affecting the Bias set up. Then connect a jumper wire between TP1 and TP2 and another jumper wire between TP3 and TP4. Using a voltmeter, with the common lead at TP1 (ground), measure the A.C. voltage at TP5. Adjust the Bias Control (R15) until this reading is maximum. It should be about .5VAC, but this will vary from unit to unit. The important thing is to obtain a maximum reading.

To make the regeneration adjustment, disconnect the jumpers and the voltmeter and turn the speaker volume control to a listenable level, or reconnect the speaker leads. Press the Squawk and Talk Test Switch and adjust the Regeneration Control (R29) until the desired number of echo repeats is heard. Usually this would be about 5 to 10 repeats, but it is a subjective matter and should be adjusted to where it sounds best.

FIELD TROUBLESHOOTING PROCEDURE
FOR
"SAY IT AGAIN" (AS-2518-81) MODULE

SYMPTOM	PROBABLE CAUSE	ACTION
I. No Sound of any kind.	1. Cables, Connectors.	Check wiring.
	2. Power supply bad.	With common lead at TP1 (GND) measure +12VDC at TP12.
	3. U3 bad.	With common lead at TP1 (GND) measure +4 to +8VDC at TP13.
	4. Squawk & Talk bad.	Refer to Squawk & Talk troubleshooting procedures.
II. Sound but no echo.	1. Bias (R15) misadjusted.	Refer to "SAY IT AGAIN" SET UP PROCEDURES.
	2. I.C. bad (U1, U2, U4-U7).	Replace module or refer to "SAY IT AGAIN" Oscilloscope Troubleshooting Procedures.
III. Too few echo repeats.	1. Regeneration (R29) misadjusted.	Refer to "SAY IT AGAIN" SET UP PROCEDURES.
IV. Too many echo repeats.	1. Regeneration (R29) misadjusted.	Refer to "SAY IT AGAIN" SET UP PROCEDURES.
	2. Bias (R15) misadjusted.	Refer to "SAY IT AGAIN" SET UP PROCEDURES.
V. Echo badly distorted.	1. Bias (R15) misadjusted.	Refer to "SAY IT AGAIN" SET UP PROCEDURES.

A17   Auxiliary Driver—G.I. Flasher
AS-2518-68
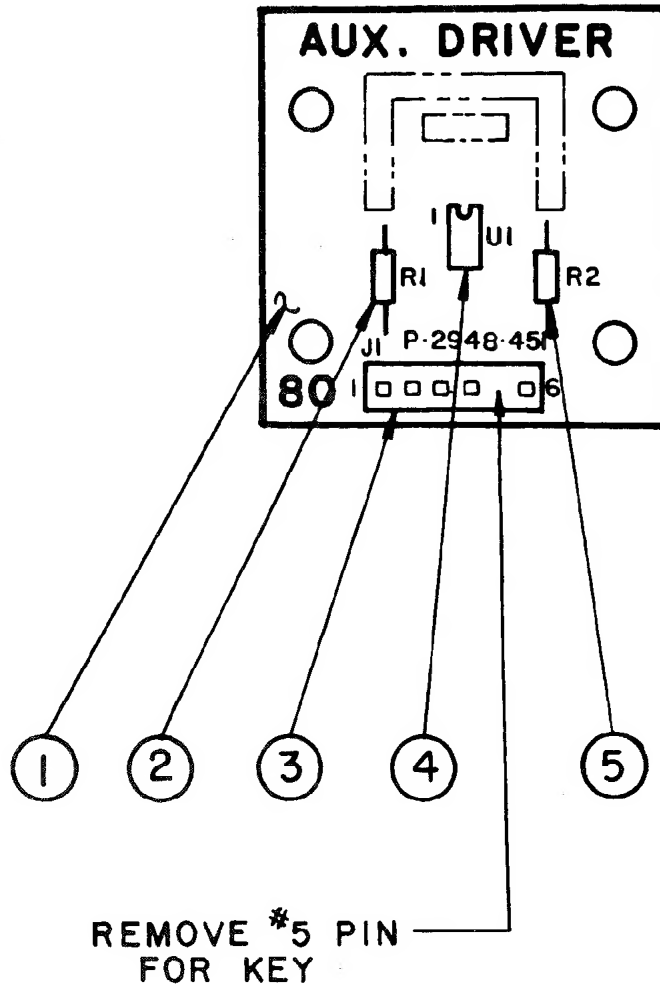
COMPONENTS PARTS LIST

ITEM	QTY.	REFERENCE DESIGNATION	DESCRIPTION	BALLY PART #
1	1	P-2948-451	P.C. Board	M-645-584
2	1	R1	330 Ω, 5% ¼W.	E-105-219
3	1	J1	6 Pin Wafer—KK156	E-736-6
4	1	U1	OPT./CP, MOC 3011	E-620-172
5	1	R2	10 Ω, 5%, ¼W.	E-105-306
REF.			Schematic	W-1253 b